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REPORT

ON

PROGRESS AND PROPOSED FUTURE EXPANSION

IN THE

UTILIZATION OF THE FOREST RESOURCES OF MADRAS

INCLUDING DATA ON COMMERCIAL FOREST RESOURCES, TIMBER IMPORTS, AND AVAILABLE MARKETS

BY

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MADRAS
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REPORT ON PROGRESS AND PROPOSED FUTURE EXPANSION IN THE UTILIZATION OF THE FOREST RESOURCES OF MADRAS.

CHAPTER I.

A. Introduction.

1. With the introduction of modern methods of forest exploitation and the establishment of Forest Department saw mills, in Madras, the existence of an enormous demand for sawn material has become evident. Many profitable orders for boards, scantlings, boxes, sleepers, etc., have had to be refused solely because of lack of equipment to supply them. Requests from the Standard Oil Company for 72,000 boxes a year worth Rs. 60,000 to us, from a Bombay firm for 5,000 tons of sawn teak a year, from the Railways for from one to two lakhs of sleepers instead of the 39,000 we are now supplying, give an indication of the many demands made upon us which we are unable to supply.

2. Madras pays out every year to foreign countries—99 lakhs of rupees for imported timber, yet she has within her borders vast areas of valuable timber forests which are practically untouched. Wtih modern logging methods, as the Forest Engineering Branch has demonstrated, all of these forests are accessible.

3. With the experience gained in the past three years during which time great strides have been made in economic forest development, it is possible to build for the future on a firmer foundation than heretofore. As this report will show, we have the raw material, we have the markets, and we have developed the nucleus of what can be made a great manufacturing and distributing organization.

It seems desirable therefore to establish a definite programme of expansion to insure uninterrupted development in the utilization of Madras forest resources.

4. The preparation of this report was prompted by Development Department O.M. No 1721-1/26-1 issued June 1926, the initial paragraph of which summarizes as follows :—

"If, as is essential in the financial interests of the Presidency and with a view to fostering its general developments, the great resources locked up in its timber forest are to be more fully made available and utilized, it is desirable that all information throwing light on these resources, the areas in which they are most readily accessible, the extent to which they are already being utilized, the quantity and variety of timbers which can be exploited, the markets for them, and all other information on which a regular programme can be based should be brought together and made available for those who have to deal with the problem."

This report is presented in an endeavour to supply, so far as it is at present available, the information requested.

B. The World Situation.

Understanding of world situation important.

5. The timber trade being internationally competitive (under normal conditions 375 crores of cubic feet valued at Rs. 1,820 crores are exported between countries), an understanding of the general situation and tendencies throughout the world is a prerequisite to consideration of forest development in Madras.

Forestry a world problem.

6. In the message read before the World Forestry Congress, the greatest meeting of foresters in history held in Rome this year, the delegates of the American Forestry Association emphasized that "Forestry has become a world problem. It will not suffice that each nation pursue its own individual course ignorant of forest development in other countries and of the international problems in forest supply that are bound to arise in years to come."

7. Wood is one of the commodities essential to human existence. As Gifford Pinchot stated in *1923 :

This is an Age of Wood.

"We are prone to call this the age of steel and of electricity, and to look upon wood as the foundation of an earlier and more primitive civilization. Yet, when one considers the part which wood plays in modern life—housing, transportation, manufactures, and particularly the dissemination of knowledge by means of books and newspapers, this is truly an Age of Wood. It is the tendency of modern times for the consumption of wood to increase throughout the world, and substitutes of wood merely create new uses for it. The problem to-day, and it is a world problem, is to make the available supplies to keep pace with the increasing need for wood".

8. A tabulation† of the world's annual consumption of wood reveals some interesting facts :—

Continent.	Total Saw timber and firewood.	Saw timber.	Percentage saw timber.	Firewood.	Per capita consumption of wood.
	CRORES OF C.FT.	CRORES OF C.FT.		CRORES OF C.FT.	
North America	2,719	1,437	52·8	1,282	188·0
Europe	1,664	884	53·1	780	35·8
Asia	792	154	19·4	638	9·1
South America	253	29	11·6	223	39·2
Africa	77	11	14·7	66	5·7
Australia	30	12	38·6	18	36·1
Total ..	5,535	2,527	45·6	3,007	32·2

The most surprising thing shown by the above statistics is the great variation in per capita consumption of wood. This is all the more striking when we consider individual countries :†

Country.	Per capita consumption.	Country.	Per capita consumption.
	C.FT.		C.FT.
Canada	2[illegible]5·0	Germany	27 0
United States of America.	228 0	France	26·3
Sweden	129·0	Italy	15·4
Norway	118·0	Great Britain	15·3
Malaya	90·9	China	6·0
Russia	66·0	India	5·0
Japan	28·4	Ceylon	3·4

The standard of living, industrial development, climate, coal, oil and iron resources, and available local supply and production of timber are among the factors affecting the use of wood.

Local wood consumption increases with forest development.

9. With reference to forest development in Madras it should be noted that making local timber more readily available tends to increase the consumption of wood. This is borne out by experience in the Philippine Islands where the local use of lumber increased from 25 million board feet to 150 million board feet with the establishment of saw mills and an extensive lumber industry.‡ General industrial development and a rising standard of living such as is taking place in India to-day also results in increased utilization of wood.

United States of America barometer of world timber market.

10. The United States of America as the biggest producer (56.2 per cent of the world's saw timber), consumer (half of all the wood used in the world), and exporter of lumber is the best barometer of the world market. Recent publication received from America emphasises the new trend of the hardwood lumber industry, with

* Foreword to Zon and Sparhawk—" Forest Resources of the World. "

† Adapted from Zon and Sparhawk—" Forest Resources of the World ", published—1923.

‡ Statement of William Crosby, Chief of the Division of Utilization and Saw Mills, Bureau of Forestry, Philippine Islands, in the " Timberman. "

which we are principally concerned in Madras. That requirements for hardwoods are not diminishing and that a shortage of domestic hardwoods is inevitable is shown by W. N. Sparhawk, Forest Economist, U.S. Forest Service, in a bulletin of the Pan American Union!

Shortage of hardwoods in United States of America inevitable.

* ". . . the hardwood lumber cut, as reported by the Census and Forest Service, showed an apparent decrease from 9 billion (board feet) feet a year during the five years 1909—13 to 6 billion feet a year during the five years 1919—23. . . a total consumption in 1919 of 8.6 billion board feet is indicated. . . If our wood using industries are to continue to grow with the population or even maintain approximately their present status they must begin soon to lay plans for securing essential raw material". He points out that almost the whole hardwood forest area of America is in private ownership, that they can sell young timber profitably and will not hold it 100 years until the large size required by manufacturing industries is reached. "It seems almost inevitable then that if we are to have adequate supplies of high grade hardwood timber after the next twenty or thirty years, we shall have to import large quantities at least for the following fifty years. There are no considerable supplies available in any of the temperate regions. . . In the tropics however the case is different. Large virgin supplies of many kinds of timber exist". After showing why tropical forest exploitation has been neglected he continues: "But now conditions are changing. The available surpluses of cheap lumber in the north temperate regions are rapidly disappearing, and such important consuming countries as France, England, Belgium and the Netherlands are beginning seriously to consider drawing on their tropical possession for large quantities of industrial and building timber. The United States. . . must fill a considerable portion of her needs for high grade hardwoods by importation. In the tropical countries themselves rail roads are being extended, and agriculture, mining, and manufacturing industries are developing rapidly. . . and their own requirements for timber are growing by leaps and bounds in consequence." Sketching the work that has to be done in research and organization in tropical forest development he concludes: "All these things cannot be accomplished in one year, or even in ten. It is hardly probable, even with intensive effort, that the tropical woods can come into our markets in billions of feet in much less than twenty years. By that time it is certain that we shall need all we can get."

Important consuming countries must import hardwoods from tropics.

"The points to be emphasized are: First, if our hardwood manufacturing industries are to survive, they must eventually utilize large quantities of timber from the tropics; and, second, the present is none too soon to commence laying the necessary foundations for such utilization in the future."

11. Another phase of the American situation which affects India is the agitation being fostered in the United States by many consuming interests to stop or restrict timber exports. It is a well-known fact that many shiploads of creosoted Douglas fir (Oregon pine) sleepers are exported to India from America. The prospect of outside sleeper supplies being cut short and prices raised is another potent argument for developing a producing organization to supply not only current but greatly enhanced future demands.

How American agitation to restrict exports affects India.

12. If further evidence is required William B. Greeley, Chief of the United States Forest Service, supplies it: † "Our magnificent forests of both softwoods and hardwoods have enabled us to export large quantities of a variety of species. The situation has however changed in recent years. Unrestricted lumbering and clearing operations and fires have reduced our forests to less than half of the original stand and the annual cut at present is four times the annual growth. The continuation of such a condition ultimately means the exhaustion of the forests of

The United States is an enormous potential market for tropical hardwoods.

* "Why the United States is interested in Latin American Forest Development", by Sparhawk—Forestry Bulletin No. 4 of the Pan American Union.

† "The United States as a market for Tropical Forest Products" by William B. Greeley—Forestry Bulletin No. 3 of the Pan American Union.

the United States. Already half of the pulpwood required for our paper consumption comes from outside the United States. . . The United States is an enormous potential market for tropical woods.''

Message to World's Forestry Congress.

Dependence of northern countries on forest resources of tropics.

Valuable special-purpose hardwoods in tropical forests.

Chief obstacle lack of knowledge of quantity and quality of tropical timbers.

13. The world situation is summed up in the American Forestry Association's message to the World Forestry Congress :—

''The American Forestry Association believes that the exhaustion of virgin forests throughout a large portion of the temperate regions of the world has reached a point which demands international consideration of future supplies for trade and industry. To this end it hopes that one of the many great results of the World Forestry Congress will be an awakening of interest in tropical forestry. It believes the increasing dependence of the northern countries on the forest resources of the tropics has reached such a proportion as to merit a prominent place for discussion and action at the Rome Conference.'' It is generally recognized that many of our valuable special-purpose hardwoods are nearing exhaustion and that for the past five years or more industries have searched for successful substitutes. It is not quite so well known except among foresters interested in the tropics that the equatorial forests contain a number of species which not only give promise of possessing qualities which have made hickory, ash, oak and other special-purpose woods so available, but which add to these additional qualities of strength and resistance to impact and decay. Tropical foresters are practically unanimous in saying that the chief if not the only obstacle which to-day has prevented tropical wood products from taking their legitimate place on the markets of the world is our lack of definite knowledge regarding the quality and quantity of these timber species and the natural unwillingness in industry to make use of unknown species without more definite knowledge as to their characteristics and availability. ''The American Forestry Association urges some definite steps whereby a survey of the extent of these resources be made and a programme of research initiated to reveal the qualities and characteristics of various species.''

What are other forested tropical countries doing?

14. What are other tropical countries doing to develop the utilization of their forest resources? Who are our far-sighted competitors who are laying the foundation to meet the present and prepare for the future demand for tropical timbers?

Philippines under conditions similar to South India successfully developed largest tropical timber industry.

15. The Philippine Islands under conditions where many points of similarity to those in South India are illustrated in ''Forest Exploitation in the Philippine Islands'' * (printed in full in the appendix of this report) pioneered the application of modern mechanical methods to tropical forest exploitation and have as a result, successfully developed the largest tropical timber industry of any country in the world. Sixty-six saw mills with a capital investment equivalent to Rs. 2.4 crores are producing one crore cubic feet of sawn lumber annually. Col. George P. Ahern, former head of the Philippine Forest Service, is authority for the statement † that ''To-day the Phillippines are exporting to fifteen countries large quantities of wood some of them not believed fit to use in 1900 . . .

The forests, 98 per cent publicly, owned are improved by cutting. Each acre cut over on the concessions brings a revenue to the Government from 10 to 25 dollars (Rs. 30 to 75).''

Burma teak supplies diminishing.

16. Burma has been for years the biggest producer of teak. Now we are informed by private importing firms in Madras that they cannot get timber of the high grades formerly obtained in Burma. A representative of Bombay timber firms was recently in Madras endeavouring to negotiate for 5,000 tons of sawn teak a year, owing to imminent shortage of

* ''Forest Exploitation in the Philippine Islands with special reference to the relationship between the Bureau of Forestry and the Private Lumbering Companies operating in Government Forests, and the mechanical logging and milling methods used together with pertinent suggestions for Madras'', by J. Kenneth Pearce.

† Australian Forestry Journal of 1st May 1926, page 140.

Burma supplies. The teak situation makes market prospects for the lesser known timbers which can be used in place of teak, and of which Madras possesses huge stands, appear bright indeed.

Prospects for lesser known timbers bright.

Dutch East Indies successful.

17. The Dutch East Indies have successfully established saw mills and plywood plants, and are not only fulfilling their own requirements for three-ply boxes, but are said to be exporting as well. The manufacture of three-ply rubber and tea boxes was introduced into the Dutch Indies in 1918 by Mr. O. Van Vauuren. In 1925 the N. V. Hout Industrie Mij. (Company), of which Mr. Van Vauuren is Manager, had three plants producing 560,000 boxes annually. Two other companies were producing 400,000 boxes annually.

Federated Malay States planing big developments.

18. The Federated Malay States are considering undertaking the exploitation of a 100,000 acre forest reserve, including railway logging, the erection of a saw mill with a maximum developed capacity of 25,000 tons per year, and an impregnation plant to treat 200,000 sleepers per annum. In addition a complete timber-testing laboratory, experimental dry kilns and commercial and experimental wood-working shops would be installed. All details of the proposed Malayan development are found in a Report by Mr. H. T. M. Kent, Controller of Timber Supplies, Federated Malay States, on "The Equipment necessary for Economic Exploitation of a Malayan Forest Reserve." In the introduction (page 4) Mr. Kent points out that the past practice of taking out only an average of one tree on two acres of only the well-known 'popular' timbers "has placed an undue strain on forest resources, and has proved to be a most uneconomical method of utilization. Times are changing and the country is faced with a shortage of the 'popular' hardwood timbers and the natural sequence—higher prices. If then the Federated Malay States is to be independent of foreign supplies, and yet obtain timber at reasonable rates without hopelessly ruining its timber lands, it becomes essential to utilize its resources more economically by substituting the little known species where possible for the 'popular' ones, and by adopting more economical methods of conversion and manufacture. To do so will be to increase the value of the virgin stand enormously and considerable expenditure in obtaining such a result will be justified".

Report of Controller of Timber Supplies, Federated Malay States.

A statement applicable to Madras.

This statement is equally applicable to Madras.

Investment of Rs. 41 lakhs in forest exploitation by Federated Malay States Government proposed.

The capital which it is proposed should be invested by the Federated Malay States Government in this enterprise totals $2,771,100 (Rs. 41,56,650) distributed as follows:—

	$	RS.
Logging equipment	300,000	4,50,000
Saw mill and log pond	395,000	5,92,500
Storage and seasoning sheds	350,000	5,25,000
Electric power house	146,000	2,19,000
Machine repair shop	25,000	37,500
Wood-working shops (commercial)	45,500	68,250
Impregnation plant	149,500	2,24,250
Timber-testing laboratory	51,000	76,500
Temporary shed	6,000	9,000
Experimental dry kiln	13,100	19,650
Do. wood-working shop	34,000	51,000
Head office equipment	6,000	9,000

Salaries and wages of staff and labour in the above plants are estimated at $378,478 (Rs. 5,67,717 per annum and total working expenses at $776,578 (Rs. 11,64,867). The estimated amount required for carrying stocks and commercial working capital is $1,250,000 (Rs. 18,75,000), for experimental working expenses $72,820 (Rs. 1,09,230).

The investment of Rs. 41 lakhs is only to start forest exploitation in Malaya. Rapid expansion is anticipated.

Developments in Central America.

19. Central America already supplies all the true (Honduras) mahogany and investigation of the much greater stands of unknown timbers and research into their use is being prosecuted, and plans prepared for their development. Donald M. Mathew, for six years Forester in the Philippines and ten years in charge of forest work in British North Borneo, has

just taken charge of a big forest research project in Cuba. In a recent publication he states: * "It seems clear enough there is plenty of work to be done . . . the first step . . . a survey of the producing field with the aim of collecting accurate data as to sources of supply of all tropical timbers . . . as a complement to this a study of the wood using industries . . . These data in hand . . . they could be put into immediate practical use in promoting the utilization of tropical timber products by industries in greatest need of them . . . As regards tropical America . . . the biggest problem is the determination of the extent and value of the potential sources of supply. The aim should be to collect data of a nature which would enable the countries owning the forests to offer concessions to capital which would be attractive enough to invest it and at the same time be so constructed as to safeguard the forest resource."

South America.

Forest investigation looked upon as investment in future.

20. South America, with vast unexplored tropical hardwood forest areas in the Amazon Basin, believed to be double the area of all United State Forests, is attracting the attention of those interested in forest development. The Pan American Union is fostering investigation looking toward the utilization of the tropical American forests, and the large sums of money being provided for this work are looked upon as investments in the future.

Rewards of tropical forest research great.

The Tropical Plant Research Foundation of Washington, D.C., is finding in forest reconnaissance wide scope for service, and their activity in this direction is being rapidly expanded. The big Corporations trading in Tropical America are taking a lively interest in developing forest exploitation. The work of all these agencies is supported by Government and private capitalists because of the realization of the trend of the hardwood lumber industry which this report has endeavoured to portray. In the words of Tom Gill, † of the Tropical Plant Research Foundation:

"The task of forest research in the tropics has hardly begun. Ten years or more may pass before the forester learns the requirements and adaptabilities of the important species. Time and money must be spent to test and determine the usefulness of their numerous woods. But the prize is proportionately great—greater, it would seem, than any rewards timber growth can offer in any other portion of the globe".

CHAPTER II.—THE PRESENT SITUATION IN MADRAS.

A. Forest Resources.

Reserved forest area.

21. There are 19,012 square miles or 12,167,680 acres of reserved forests in the Presidency of Madras, of which 14,858 square miles are forests considered of sufficient value or importance to be permanently retained under the control of the Forest Department.‡

Area of Commercial Forests.

22. When this report was called for by Government the Chief Conservator of Forests requested the District Forest Officers of the various divisions in which big timber forests were believed to occur, to report the acreage of commercial forest in their divisions. The definition of "commercial forest" was given as forest "containing not less than 350 cubic feet per acre of timber over $3\frac{1}{2}$ feet girth suitable for exploitation. The dividing line of 350 cubic feet per acre between commercial and non-commercial forests was taken because all mechanical extraction on a large scale is known to be feasible in a stand of that density. The reports of the District Forest Officers are tabulated on the adjoining sheet grouped in working (exploitation) units, and show a total of 557,553 acres or 871 square miles of commercial forest. An additional tabulation of reports on important forests which are being exploited in this area on a considerable scale but which contain less than 350 cubic feet per acre is also given, and totals 101,420 acres or 158 square miles.

* "Logging and Marketing Problems with Tropical Timbers"—Forestry Bulletin No. 9 of the Pan American Union.

† "Tropical Forestry and Research" by Tom Gill, of Tropical Research Foundation, published as Bulletin No. 11 of the Pan American Union.

‡ (G.O. No. 103, Development, dated 12th May 1925)

Tabulation of Commercial Forest Areas.

Working unit.	Division and district.	Name of reserve or range or forest type.	Commercial forest area (containing not less than 350 cubic feet per acre over 3½ feet girth suitable for exploitation) in acres.	Actual stand in cubic feet where cruised.	Area exploited last two financial years.								Remarks.
					Year.	By clear felling.		By selection felling.		By other process.		Total	
						Acres.	Tons.	Acres.	Tons.	Acres.	Tons.	Tons.	
1. Wynaad . ..	Wynaad, North Malabar.	Evergreen ..	25,488	..	1925–26	200	2,769	800	1,427	..	380	4,576	Data furnished by District Forest Officer.
		Deciduous ..	51,688	..	1924–25	200	2,537	500	878	..	53	3,468	
2. Nilambur	Nilambur, South Malabar	Nilambur and Amrampalam Range—											
		1. Plantation Working Circle.	1,479	..	1924–25	196	2,461·5	..	..	* 65	2,483·1	4,945	* By final felling of plantations.
		2 Conversion Working Circle.	7,293	..	1925–26	138	1,174·5	..	..	* 106	3,774	4,948·1	
		3. New Amrampalam ~~Regeneration area.~~	52,200	..	..	..	..	..	..	..	..	..	New Amrampalam area below 5,000 feet contour.
		4. Nellikutta.	1,539	..	..	..	..	..	..	..	..	..	
3. Olavakkot	Palghat, South Malabar.	Attapadi	25,190	..	..	..	..	..	..	..	..	..	District Forest Officer's estimate—half total area. Attapadi and Silent Valley forests.
		Silent Valley	11,060	..	1924–25	160	2,282	..	..	..	..	2,282	Only unexploited area of Chenat Nair included. Total Chenat Nair is 7,602 acres.
		Chenat Nair	5,297	..	1925–26	248	3,744	..	..	..	..	3,744	
		(a) Elival	(a) 3,000	368 cubic feet per acre.	..	..	..	..	..	..	..	..	(a), (b) and (c) included in 5,297 acres.
		(b) Kalladikode	(b) 1,597	400 cubic feet per acre.	..	..	..	..	..	..	..	..	
		(c) Sappal and Dhoni ..	(c) 700	..	..	..	..	..	..	..	..	..	
4. Mount Stuart ..	South Coimbatore, Coimbatore.	Mount Stuart Reserve ..	15,000	..	1924–25	251	1,193·2	425	1,934	..	..	3,127·2	Data furnished by District Forest Officer, Mount Stuart, is under working plan.
		Ulandi Forest ..	4,940	..	1925–26	261	633·6	250	981·5	..	..	1,615·1	
		Karian Shola	3,652	..	..	..	..	..	..	..	..	..	
5. Valparai	South Coimbatore (Anamalais), Coimbatore.	Kal Ar Valley	23,000	..	..	..	..	..	..	..	..	..	Data furnished by Deputy Director of Agriculture, Cinchona.
		(a) Kal Ar Valley ..	(a) 1,017	476 cubic feet per acre.	..	..	..	..	..	..	..	..	(a) Included in 23,000 acres.
6. Papanasam	Tinnevelly ..	Kodamadi Range ..	2,966	..	..	..	..	..	..	..	..	..	Furnished by District Forest Officer.
		Kannikatti Range ..	3,000	..	..	..	..	..	..	..	..	..	

Tabulation of Commercial Forest Areas—*cont.*

Working unit.	Division and district.	Name of reserve or range or forest type.	Commercial forest area (containing not less than 350 cubic feet per acre over $3\frac{1}{2}$ feet girth suitable for exploitation) in acres.	Actual stand in cubic feet where cruised.	Area exploited last two financial years. Year.	By clear felling. Acres.	By clear felling. Tons.	By selection felling. Acres.	By selection felling. Tons.	By other process. Acres.	By other process. Tons.	Total Tons.	Remarks.
7. Vasudeva nallur ..	Tinnevelly ..	Srivilliputtur, Kuttalam Range.	20,000	..	..	..	..	..	..	..	..	..	Estimate of Range Officers and the Acting Logging Engineer who have been in charge of these ranges.
8. Kallakad	Tinnevelly ..	Nanguneri Range ..	19,000	..	..	..	..	..	..	..	..	..	
9. Ganjam	Ganjam ..	Sal Timber Working Circle.	8,516	..	1924–25	268	500	*	2,216	..	..	2,716	* Not known.
		Ravine Working Circle.	9,952	..	1925–26	190	664	*	29	..	..	693	District Forest Officer's estimate.
10. Upper Godavari ..	Godavari ..	Dummagudam and other 22 reserves.	32,006	..	1924–25	154	752	1,900	62	20	109	923	District Forest Officer's estimate.
					1925–26	195	568	1,459	124	22	240	932	
11. Lower Godavari ..	Godavari.. ..	Peddapur Range ..	500	..	..	..	..	..	..	..	..	..	District Forest Officer's estimate.
12. Someswar	North Mangalore, South Kanara.	All ghat forest reserves.	126,615	500 cubic feet per acre.	1924–25	..	..	84	58	..	..	58	Half of South Kanara forest area excluding isolated reserves taken in absence of data from the District Forest Officers with approval of acting and permanent Chief Conservators of Forests. (a) Included in 126,615 acres.
					1925–26	..	..	84	144	..	..	144	
					1924–25	..	..	500	402	..	..	402	
					1925–26	..	..	358	504	..	..	504	
					1924–25	..	..	582	465	..	..	465	
		(a) Someshwar Reserve..	(a) 11,400		1925–26	..	..	212	468	..	..	468	
13. Parappa portable saw mill.	South Mangalore, South Kanara.	....	107,172	..	..	..	..	..	..	..	..	..	
		Total ..	557,553	..	Total ..	2,461	19,278	7,154	9,692	213	7,039	36,010	
		Average per annum ..	..	..		1,230	9,639	3,577	4,846	106	3,519	18,005	

23. In the absence of accurate stock mapping in most of the areas reported on, the figures given are necessarily the opinions of the District Forest Officers as to the extent of commercial forest areas in their divisions and may be taken as very conservative. In the case of South Kanara forests the commercial forest area was taken as only half of the area of exploitable ghat forests, it being assumed that rock, grass, kumri, and forest containing less than 350 cubic feet per acre would take up half the reserve areas. The forest acreage is probably actually greater than shown in the tabulation.

Figures conservative.

It must also be remembered that there are large areas of forest containing less than 350 cubic feet to-day that are adding volume increment every year and would pass the 350 cubic feet mark well within the present rotation. Of course we also have areas which are decadent having passed maturity and each year are losing volume in decay. This makes their exploitation all the more urgent if anything is to be salvaged from them.

To be well on the conservative side, we will base our calculations and future development programme on the assumption of 557,553 acres of commercial forest as tabulated.

24. Little is known of the extent and nature of the different species of timber in each unit except in the case of areas where cruising (accurate enumeration) has been done. Detailed figures on the latter are so bulky as to preclude their inclusion in this report. They are available in the Chief Forest Engineer's Office when required. The following abstract will give an indication of the relative quantities of the principal species :—

I. *Kal Ar Valley* (*Anamalais*).

(Cinchona Estate Extension Forest)—

Mesua, Cullenia, Dichopsis, Miscellaneous species. Approximately, Mesua 40 per cent, Cullenia 20 per cent, Dichopsis 20 per cent, and Miscellaneous 20 per cent.

II. *Chenat Nair Reserved Forest*—(Sappal Valley).

Dichopsis elliptica 30 per cent, Cullenia excelsa 20 per cent, Mesua ferrea 20 per cent, Miscellaneous 30 per cent.

III. *Karian Shola Forest* (*Mount Stuart*).—

Calophyllum tomentosum 30 per cent, Hopea 15 per cent, Mesua ferrea 15 per cent, Dichopsis elliptica 10 per cent, Disoxilum malabaricum 10 per cent, Miscellaneous 20 per cent.

IV. *Someshwar Reserved Forest* (*South Kanara*)—

(a) *Durgamalai D Line*—

Terminalia paniculata 30 per cent, Terminalia tomentosa 20 per cent, Lagerstroemia lanceolata 15 per cent, Mangifera indica 5 per cent, Dillenia pentagyna, Trewia nudiflora, Albiazzia sp., and Chikrassia tabularis—all 20 per cent, Hopea parviflora 10 per cent.

(b) *Ogranibettu Valley Z Line*—

Eugenia gardneri 15 per cent, Calophyllum sp. 20 per cent, Hopea parviflora 20 per cent, Terminalia paniculata 15 per cent, Mangifera indica, Machillus macranatha, Lagerstroemia lanceolata and Polyalthia fragrans—all 20 per cent—Poecilneuron indicum 10 per cent.

(c) *Kollangar Valley P Line*—

Hopea parviflora 20 per cent, Poeciloneuron indicum 15 per cent, Dipterocarpus 25 per cent, Laphopetallum weightianum 10 per cent, Canarium strictum, Machillus macrantha, Cinamum zeylanicum and Polyalthia fragrans—all 20 per cent, Lagerstroemia lanceolata 10 per cent.

(d) *Barodiani D Line*—

Hopea 15 per cent, Calophyllum species 20 per cent, Terminalia species 20 per cent, Eugenia gardneri 10 per cent, Chickrassia tabularis, Lagerstroemia and Vitex altissima 15 per cent—Poecilneurun indicum 10 per cent, other species 10 per cent.

IV. *Someshwar Reserved Forest* (*South Kanara*)—cont.

(e) *Melgaddi Valley E Line*—

Hopea parviflora 15 per cent, Poeciloneurun indicum 25 per cent, Eugenia gardneri 10 per cent, Laphopetallum 10 per cent, Cinamum zeylanicum 15 per cent, Lagerstroemia lanceolata, Terminalia paniculata, and Vitex altissima all 25 per cent.

25. The data on the number of cubic feet of each species in the first four blocks* to be exploited in Elival Valley, Chenat Nair Reserved Forest, are given to show the detailed information which is available from the cruise made by the Logging Engineering Division. In addition we also have cover maps prepared which show the number of cubic feet of each species on each 2 acres.

Block I—Elival Valley.

(349 acres between A and B lines at the foot of the Elival Valley up to approximately 900 feet contour.)

Species.	Cubic contents. C.FT.	Species.	Cubic contents. C. FT.
Lagerstrœmia flosreginæ	386	Stephgyn parviflora	160
Tectona grandis	844	Sterculia spp.	40
Grewia tiliæfolia	19,048	Acrocarpus fraxinifolius	74
Xylia xylocarpus	16,572	Homalium zeylanicum	220
Albizzia spp.	5,481	Tetrameles	658
Lagerstrœmia lanceolata	3,271	Mangifera indica	48
Sch. trijuga	761	Artocarpus hirsuta	216
Pterocarpus marsupium	338	Sacopetallum tomentosum	120
Cedrela toona...	374	E. Tuberculatus	112
Bombax	2,328	Dichopsis elliptica	22
Holigarna	1,822	Hydnocarpus wightiana	48
Terminalia spp.	18,368	Bischofia javanica	332
Dalbergia latifolia	1,050	Spondias mangifera	35
Dillenia pentagyna	544	Alstonia scholaris	777
Bridelia redusa	216	Odina wodifer	264
Stereospermum chelenoides	2,471	Miscellaneous	10,029
Anogeissus latifolia	726	Holoptela integrifolia	104
Michellia macrantha	1,168		
Adina cordifolia	230	Total ...	89,679
Vitex altissima	20		
Garcenia indica	402	Poles ...	1,020

Block II—Elival Valley.

(158 acres lying approximately north of Block I from B 41·05 to B 73·86 up to approximately 1,500 contour.)

Species.	Cubic contents. C.FT.	Species.	Cubic contents. C.FT.
Tectona grandis	1,420	Homalium zeylanicum	112
Grewia tiliæfolia	1,958	Tetrameles nudiflora	252
Zylia zylocarpus	4,768	Mangifera indica	270
Albizzia spp.	1,363	Artocarpus hirsuta	124
Lagerstrœmia lanceolata	3,590	Saccopetalum tomentosum	20
Sch. trijuga	398	Elæcarpus tuberculatus	55
Pterocarpus marsupium	172	Bischofia javanica	854
Bombax malabaricum	588	Alstonia scholaris	467
Holigarna arnottiana	35	Odina wodier	70
Terminalia spp.	958	Acacia leucophlea	88
Terminalia belerica	1,234	Melochia velutina	248
Terminalia paniculata	3,264	Hopea parviflora	518
Terminalia tomentosa	838	Eugenia gardneri	168
Dalbergia latifolia	722	Macaranga roxburghi	68
Dillenia pentagyna	64	Miscellaneous	4,624
Stereospermum spp.	1,312		
Anogeissus latifolia	723	Total ...	40,343
Machilus macrantha	512		
Vitex altissima	146	Poles ..	417
Adina cordifolia	196		
Stephegyne parviflora	44		

* There are 5 more blocks, totaling 1,929 acres, containing much heavier stands.

Block III—Elival Valley.

(176 acres north of block II and comprising the north-westernmost valley in Map.)

Species.	Cubical contents. C.FT.	Species.	Cubical contents. C.FT.
Mesua ferrea	19,262	Canarium strictum	216
Calophyllum elatum	27,896	Terminalia belerica	466
Michælia macrantha...	3,651	Do. paniculata	692
Acacia leucophlœa	38	Tetrameles nudiflora	284
Alstonia scholaris	346	Eugenia spp.	2,002
Hopea parviflora	664	Lagerstrœmia lanceolata	704
Dichopsis elliptica	2,670	Mangifera indica	1,110
Saccopetalum tomentosum	56	Sterospermum chelenoides	40
Culleinia excelsa	1,128	Bombax malabaricum	124
Sterculia spp.	2,100	Holigarna arnottiana	957
Grewia tiliæfloia	318	Dillenia pentagyna	232
Homalium zeylanicum	680	Elæocarpus tuberculatus	167
Bichofia javanica	3,042	Dalbergia latifolia	158
Artocarpus hirsuta	108	Polyalthis fragrans	72
Acrocarpus fraxinifolius	3,986	Disoxylum malabaricum	142
Anthocephlus cadamba	72	Diosperus insignis	252
Spondias mangifera	20	Hemicyclia eleta	38
Diosperous ebunum	1,206	Miscellaneous	18,828
Adina cardifolia	366		
Schleichera trijuga	35	Total ...	94,872
Artocarpus integrifolia	88		
Xylia xylocarpus	38	Poles ...	1,608
Myristica	582		
Cinnamomum zeylanicum	36		

Block IV—Elival Valley.

(388 acres lying at the base of the Map approximately between B and C lines up to about the 600 feet contour.)

Species.	Cubical contents. C.FT.	Species.	Cubical contents. C.FT.
Anogeissus latifolia	534	Bischofia javanica	68
Tectona grandis	136	Adina cordifolia	160
Terminalia tomentosa	4,864	Odina wodier	56
Terminalia paniculata	15,456	Albizzia lebbek	160
Terminalia belerica	9,784	Albizzia odoratissima	4,385
Xylia xylocarpus	12,446	Sterculia spp.	3,079
Hopea parviflora	40	Lagerstrœmia flosreginæ	84
Calophyllum elatum	308	Pterocarpus marsupium	474
Garcinia indica	384	Grewia tiliæfolia	28,436
Zanthoxylum rhetsa	48	Bridelia retusa	192
Saccopetalum tomentosum	92	Bombax malabaricum	4,390
Anthocophalus cadamba	48	Holigarnia arnottiana	2,417
Mangifera indica	84	Dillenia pentagyna	320
Sch. tijuga	618	Miscellaneous	4,802
Alstonia scholaris	180		
Dalbergia latifolia	424	Total ...	101,158
Machillus macrantha	2,325		
Lagerstrœmia lanceolata	4,200	Poles ...	1,792
Artocarpus spp.	164		

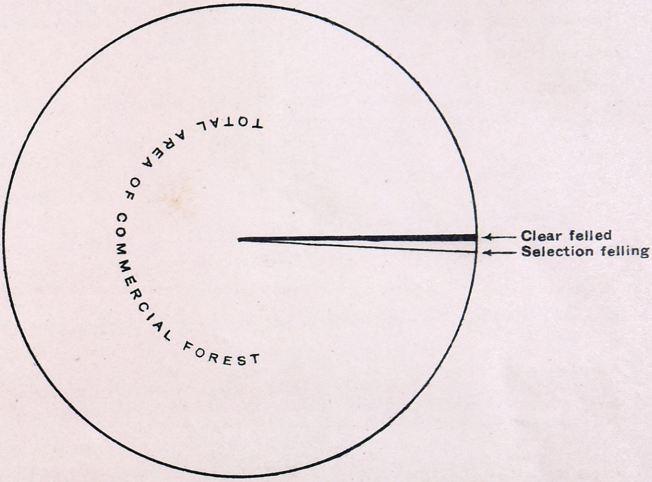
B. Areas Annually Exploited.

Commercial forest area now exploited.

26. The tabulation of commercial forest areas gives also the area exploited during the last two financial years (1) by clear felling and (2) by selection fellings. The average is 1,230 acres clear felled annually yielding 9,639 tons. The areas clear felled thus yielded an average of 392 cubic feet per acre. In five out of the six working units in which clear felling operations were carried out, only the few readily marketable species were extracted, which indicates that with the increased utilization of hitherto commercially unknown species which is being pressed by the Forest Engineering Branch, the yield from commercial forests will average more than 392 cubic feet per acre.

COMPARISON BETWEEN

TOTAL AREA OF COMMERCIAL FOREST AND AREA EXPLOITED ANNUALLY.



	Acres,
Total area of Commercial forest (containing over 350 c. ft. per acre)	5,57,553
Area clear felled annually (average of 1924-25 and 1925-26)	1,230
Area worked over annually by selection fellings (average of 1924-25 and 1925-26)	3,577
Note.—Does not include 106 acres felled by other processes	106

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The average yield from selection fellings was 4,846 tons selected from an area of 3,577 acres (plus acreage worked over in Ganjam which is not given). This means that only one or two trees were removed from each acre. By other processes an average of 3,519 tons were removed from 106 acres, the greater part of this being final fellings in Nilambur teak plantations. The total average annual yield from areas classed as commercial forests was thus 18,005 tons.

C. Total Annual Production from Madras.

Reserved Forests.

Commercial forest areas not only ones capable of timber production.

27. That what have been designated as commercial forests are not the only ones capable of producing timber is evident when we consider the total annual timber yield from all the reserve forests of the Madras Presidency as given in the administration report for 1924-25:

	C FT.		C.FT.
Logs removed by Government Agency.	983,000	Sawn material and squares removed by Government Agency.	242,000
Logs removed by private purchasers or consumers.	1,078,000	Sawn material and squares removed by Private Agency.	12,000
Logs removed by free permit-holders.	78,000	Total sawn and squares ...	254,000
Total logs ...	2,139,000	Grand total logs, sawn material, and squares removed 1924–25 from Madras forests.	2,393,000 or 47,860 tons.

Of this the commercial forests yielded only 18,386 tons or 38 per cent.

D. Imports.

Average annual imports of timber.

28. The total imports of timber and manufactured wooden articles into all the ports of the Madras Presidency average Rs. 98,71,068 per annum in value. This average has been taken over the last five years. Of this sum, Rs. 82,84,438 is for timber in the form of logs, squares and scantlings, and the remaining Rs. 15,86,630 represents the value of manufactured wooden articles imported. These figures are for timber coming into the Presidency by her sea-ports only. No information is available regarding the quantity that comes in over her land frontiers. It is believed, however, that this is negligible.

The following averages are based on actual data received from the Collector of Customs, Madras:—

Value of average annual imports for five years ending 1925–26.

	RS.
Teak from Burma	79,50,737
Wooden tea chests	9,59,213
Wooden sleepers	5,13,007
Tropical hardwoods other than teak, gurjan, padauk and jarrah.	2,35,411
Mouldings	1,08,364
Gurjan and Padauk from Andamans	43,531
Teak from other sources	38,915
Jarrah wood from Australia	13,324
Shuttles	6,046
Deal and pine wood	2,520
Total ...	98,71,068

29. A study of the detailed yearly figures reveals several important trends which are shown graphically in the accompanying illustrations.

30. The importance of wooden tea chests (three ply) has nearly doubled in the past five years, imports in 1925-26 being valued at Rs. 11,69,879. Most of these are shown as coming from the United Kingdom but it is believed that many are manufactured in Scandinavia and transhipped at British Ports. German, Russian, and Japanese tea chests are just beginning to appear on the market.

Wooden tea chest imports doubled.

31. While the imports of teak from Burma which comprise 80.6 per cent of the total imports are apparently fairly constant, the imports of other species from Burma have decreased from 1,333 tons valued at Rs. 1,42,920 in 1921-22 to 57 tons valued at Rs. 7,337 in 1925-26. It might be conjectured that this decline was due to the substitution of Madras timbers which have been more extensively exploited and utilized.

Teak and other tropical hardwoods.

32. Tropical hardwoods, other than teak, gurjan and padauk are supplied principally by Ceylon, Straits Settlements, Siam and the Phillippines, Ceylon leading with an average export to Madras to the value of Rs. 1,24,130 annually, chiefly of Melia composita, Bomba mimusops and jackwood. Ceylon and Siam are the chief sources of supply of teak other than Burma.

33. Sleeper imports, on an average next in importance to teak and tea chests, fluctuate irregularly. As is shown graphically no sleepers were imported in 1921-22 and 1924-25, all supplies being obtained in India, while in 1922-23, 8,364 tons worth Rs. 14,84,232 were imported, 4,331 tons of Douglas fir coming from Canada and the balance jarrah wood from Australia.

Sleeper imports.

34. Germany supplies most of the mouldings, which include picture moulding, electric light wire casing, etc., with Italy, United Kingdom and Japan ranking in the order named.

Mouldings.

Aside from tea chests and mouldings, shuttles are the only other wooden articles imported in sufficient quantities to be mentioned in the Customs statistics.

35. A comparison of imports with domestic production reveals some startling facts, shown graphically in the accompanying illustration.

Comparison imports with local production.

The total *gross* revenue from all timber removed by Government Agency and private purchasers or consumers from all Madras forests was Rs. 12,59,778 (average of 1922-23 and 1923-24) or only 12.8 per cent of the average timber imports of Rs. 98,55,224.

The total amount of timber removed from Madras commercial forests was only 18,004 tons (average of 1924-25 and 1925-26) or 30.5 per cent of the 59,218 tons imported (average of last five years).

Adding the total tonnage produced from the 18,921 square miles of non-commercial forest of 29,474 tons (1924-25) to the 18,386 tons produced from commercial forest the same year, the total produced in Madras was 47,860 tons still 30 per cent smaller than the average quantity imported.

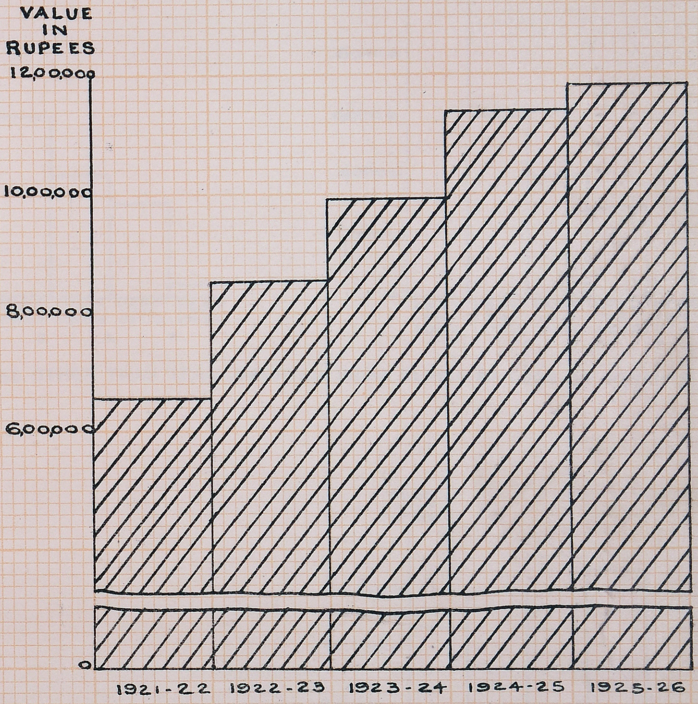
36. With regard to the annual production from private forests in Madras no statistics are available. However they are unnecessary for the purposes of this report, as we do not contemplate entering into competition with private interests. They will continue to supply their usual markets until such time as the private forest stands are exhausted. The quantities taken by private mills and timber merchants from Government forests are included in the annual administration report of timber removed. They will continue to receive the supplies they require, and they are also being helped to increase their outturn (and coincidently the utilization of Madras forest resources) by the technical advice of the Forest Engineering Branch on saw mills, seasoning, etc., and by Government loans through the Department of Industries to enable them to purchase modern equipment.

Local production by private interests and from private forests.

37. The statistics on private production, if they could be obtained, would be of interest in determining the total timber consumption of Madras. However the

VALUE OF

WOODEN TEA CHESTS IMPORTED ANNUALLY FOR THE LAST 5 YEARS.



TABULATION

Year	Value	Imports.
1921-22	Rs.	6,59,391
1922-23	,,	8,53,813
1923-24	,,	9,84,222
1924-25	,,	11,28,770
1925-26	,,	11,69,879

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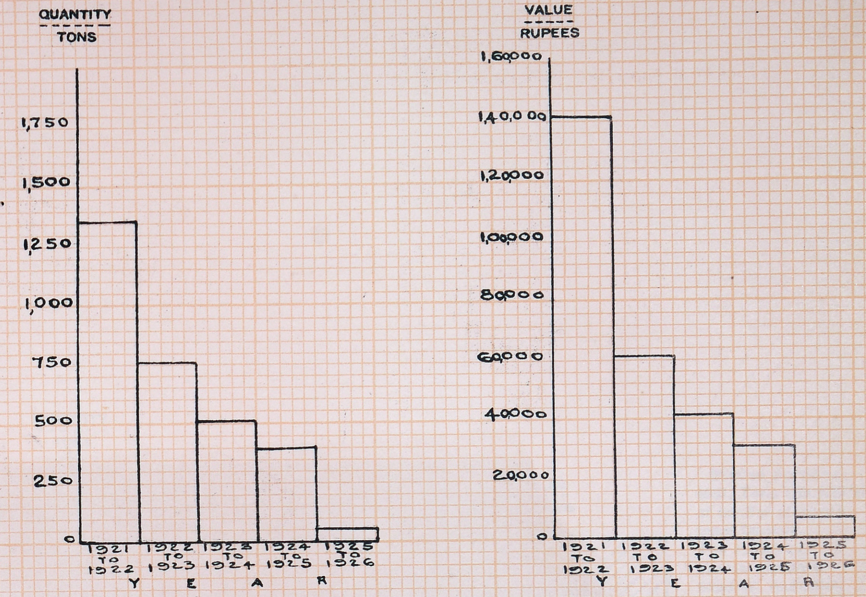
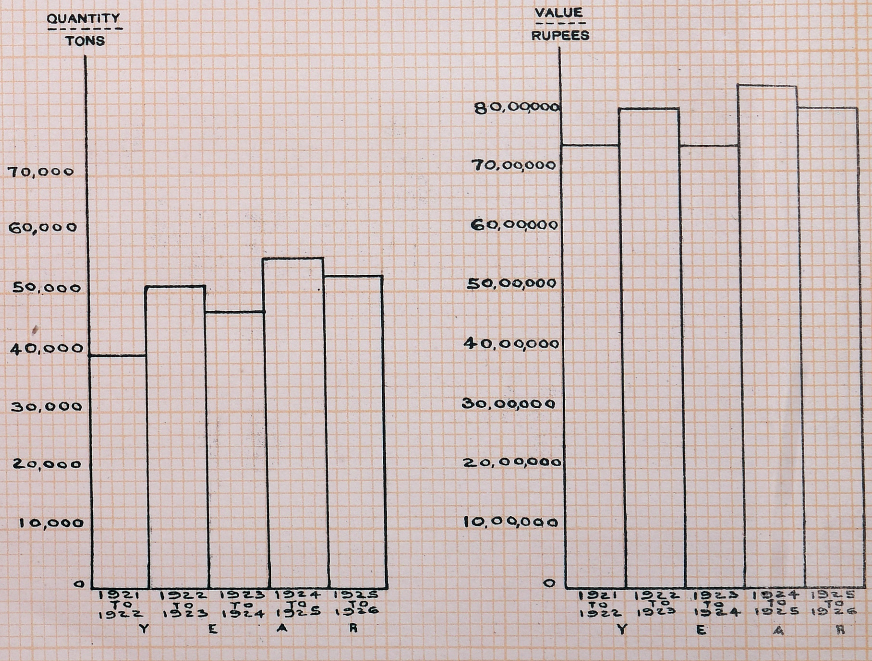
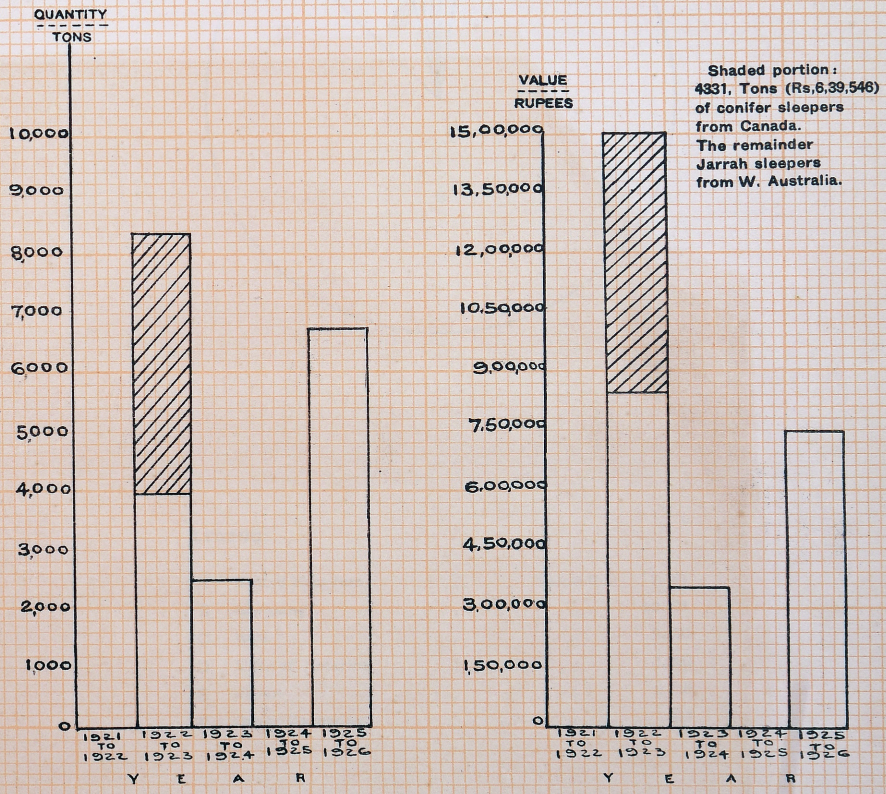


SPECIES OTHER THAN TEAK IMPORTED. FROM BURMA AS LOGS OR SQUARES.

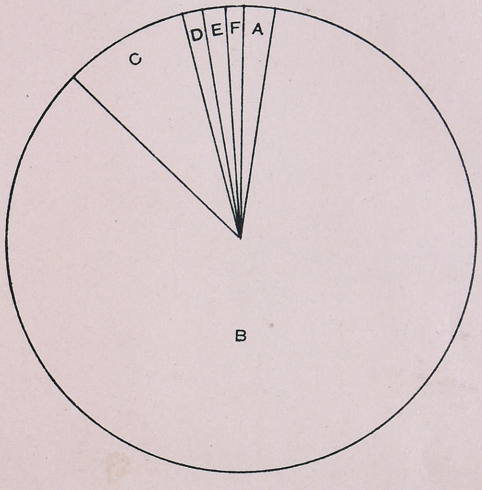


TOTAL YEARLY IMPORTS OF TEAK-WOOD.



ANNUAL IMPORTS OF SLEEPERS FOR THE LAST 5 YEARS

IMPORTS OF MOULDINGS
FROM
DIFFERENT COUNTRIES.



LEGEND:

A	United Kingdom	Value Rs.	2,181
B	Germany	,,	92,701
C	Italy	,,	9,250
D	U.S. of America	,,	1,296
E	Japan	,,	2,018
F	Other Countries	,,	917

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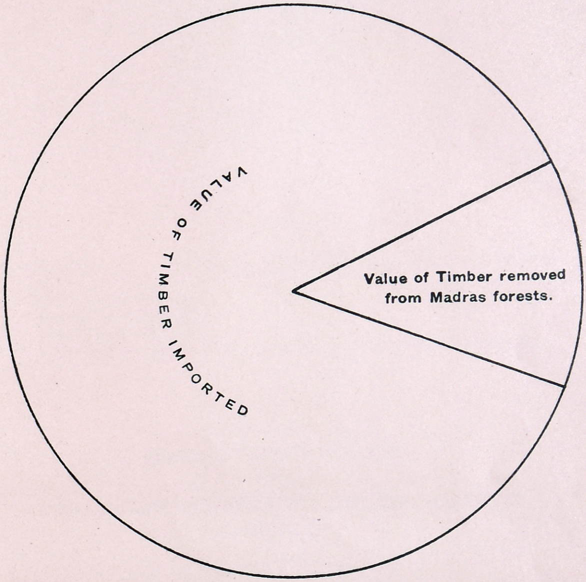
COMPARISON OF

VALUE OF TIMBER IMPORTED ANNUALLY WITH VALUE OF ALL TIMBER REMOVED FROM MADRAS FORESTS ANNUALLY.



Value of Timber and wood imported.............. Rs. 98,55 224
(average of 5 years 1920-21 to 1925-26)

Value of all timber removed by Government Agency and private purchasers or Consumers from Madras Reserved forests (Based on Gross Revenue figures in 1924-25 Administration report) excludes Sandal wood.................................Rs. 12,59,798
(average for 1923-24 and 1924-25)

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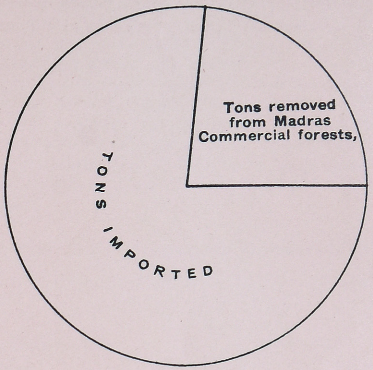
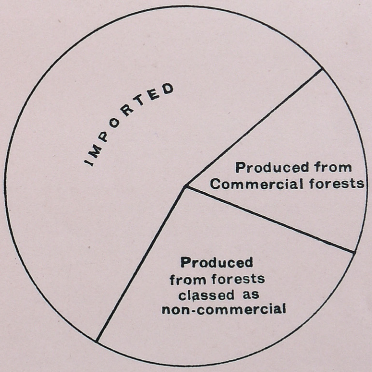
COMPARISON OF ANNUAL TIMBER IMPORTS WITH TIMBER REMOVED FROM MADRAS COMMERCIAL FORESTS ANNUALLY.



Imported ... ... 59,218 Tons (Average for 5 years 1920-21—1925-26)

Produced from Madras Commercial forests (containing over 350 cubic feet per acre) 18,004 Tons (Average of 1924-25 and 1925.26)

COMPARISON OF ANNUAL TIMBER IMPORTS WITH TIMBER REMOVED FROM ALL MADRAS FORESTS ANNUALLY



Imported ... ... 59,218 tons
(Average of 5 years 1920-21 to 1925-26)

Produced from forests class as commercial ... ... 18,386 tons
(figures for 1924-25)

Produced from forests classed as non-commercial ... ... 29,474 tons
(figure for 1924-25)

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volume of imports plus timber removed from Government forests, approximately 53.5 lakhs cubic feet annually, indicates that the demand for timber for construction purposes, railways, boxes, etc., is far greater than is usually realized. In addition, the annual administration report (for 1924-25) shows that 22 lakhs cubic feet are removed from Government forests in the form of spokes, felloes, poles, driftwood and agricultural implements (given under the heading 'Miscellaneous'). It is believed that the output from private forests is at least as great as from Government reserves, which would bring the total annual consumption in Madras to approximately 1.21 crores cubic feet. It must be noted that fuel wood or bamboos are *not* included in any of the statistics in this report.

Estimated total annual consumption.

E. Demands of Principal Consumers of Timber in Madras.

38. The demands of the principal consumers may be considered under four main headings :—

(1) Railways.
(2) Public Works Department.
(3) Planting Industry.
(4) Miscellaneous demands.

Railway demands.

39. Railways.—The railway companies of the Madras Presidency are comprised almost entirely of the Madras and Southern Mahratta and the South Indian Railways and are one of the largest individual consumers of timber in the Presidency. The timber is used mainly for sleepers, building and construction, and for locomotive and carriage works.

40. *Sleepers.*—The average annual requirement may be tabulated as follows :—

Present.	B.G.	M.G.	N.G.	Total.
Madras and Southern Mahratta Railway ..	250,000	250,000	..	500,000
* South Indian Railway	50,000	360,000	10,000	420,000

* Note.—This figure excludes new construction works but as steel sleepers are being used for this work, the quantities could not be ascertained from the timber returns.

The actual figures for the 1926-27 supply are interesting—

—	B.G.	M.G.	Total.	Cubic feet.
Madras and Southern Mahratta Railway ..	209,964	329,600	539,564	..
South Indian Railway	65,900	362,500	428,400	..
	275,864	692,100	967,964	1,900,225

Of this total, only 388,412 cubic feet or 20 per cent is obtained from within the Presidency—855,912 cubic feet or 46 per cent from Canada, United States of America, and Australia, and 640,900 cubic feet or 34 per cent from other parts of India.

The above statistics do not include special sized sleepers or narrow gauge sleepers of which a large quantity is required. For example, the South Indian Railway require approximately 45,000 cubic feet for point and crossing sleepers for maintenance and replacements on their present lines. Of this 45,000 cubic feet approximately 20,000 cubic feet is imported Burma teak and the remaining 25,000 cubic feet is obtained from the West Coast of Madras and is composed of Mesua (Nangal), Hopea (Irumbogam) and Xylia (Irul).

41. *Future.*—The above average figures may be taken as a fair indication of future supplies at least for a further five years. The quantities may vary slightly from year to year, according to funds available.

42. *Building and construction.*—The average annual demands under this heading are—

Present.	Teak.	Junglewood.
Madras and Southern Mahratta Railway.	12,000 cubic feet in logs. 40,000 cubic feet in scantling.	1,600 cubic feet in log.

NOTE.—The figures for the South Indian Railway are not available as all repairs to buildings, etc., are effected by private contracts. Hence, it may be assumed that all timber used in this respect is obtained locally—whether originally imported or obtained from the local forests. Very little timber is being used under new works of construction, as steel is being employed for doors, window, rafters, etc.

The majority of the Madras and Southern Mahratta Railway teak scantlings are being obtained from Madras supplies. Burma teak is much preferred for the proportion shown as logs owing to better conversion factors. The junglewood is obtained mainly from the West Coast.

Future.—These figures may be taken as a true indication of requirements for the next five years.

43. *Locomotive and Carriage works.*—The average annual demands are stated to be—

Present.	Teak.	Junglewood.
	TONS.	TONS.
Madras and Southern Mahratta Railway.	1,500 to 1,800	1,000
South Indian Railway	1,000	160

The Madras and Southern Mahratta Railway and the South Indian Railway have almost invariably obtained their teak for loco and carriage works from Burma in the form of squares.

The Madras and Southern Mahratta supplies of junglewood are all obtained from the West Coast and are made up of approximately 20 per cent Lagerstroemia lanceolata (Benteak), 20 per cent Artocarpus integrifolia (Hebbalasu), 20 per cent Terminalia paniculata (Honal), 25 per cent Calophyllum tomentosum (Poon), 13 per cent Pterocarpus marsupium (Honne), and 2 per cent Dalbergia latifolia (Rosewood).

The South Indian Railway junglewood is almost entirely Hardwickia pinnata (Malabar Mahogany) and is obtained from the West Coast.

44. *Future.*—The above figures may be taken as an indication for future demands, but may fluctuate from year to year, for example, in 1926-27 the Madras and Southern Mahratta Railway require 2,800 tons of teak and 1,600 tons of junglewoods. The South Indian Railway will probably increase their requirements of teak to 1,500 tons in 1929-30 and 1930-31.

Public Works Department requirements.

45. PUBLIC WORKS DEPARTMENT—*Present.*—No definite figures as regards the requirements of the Public Works Department can be obtained. The Buildings and Roads Branch is responsible for a large consumption of timber and it appears certain that the building programme is rapidly on the increase. Most of the Public Works Department work is done on contract and it may be taken that a large quantity of timber in log bought from the Forest Department in the past has gone into this class of work.

Future.—As the work is to increase in the future, it naturally follows that the demand for timber will increase also, and this factor must be allowed for in considering increased exploitation of Government forests.

As regards the Irrigation Branch, the only big project which will demand special attention is that at Mettur. Proposals are under investigation for a light railway to connect Mettur with a nearest railway station, and large quantities of sleepers will be required. There will also be required a considerable quantity of building material for the buildings at Mettur.

46. PLANTING INDUSTRY.—The planting industry makes two special demands on the timber industry:—

(a) For boxes.
(b) For constructional timbers.

47. *Boxes—Present.*—The industry requires two classes of boxes, one for transportation purposes within India and the other for export purposes. The former are provided almost entirely from local sources and are called "country" chests or boxes. The latter are invariably 3-ply chests or boxes imported from the United Kingdom. The 3-ply chest is much preferred owing to its better storage qualities, its lightness and better appearance, but it costs two to three times as much as the country chest. The country chest, being not as good as the ply chest but much cheaper, is used for transporting the lower grades of the product over short distances to local markets. The great difficulty is to secure species of timber light enough to meet rail transportation necessities. The importance of the imported tea chest trade may be gauged from the figures showing the value of imports in 1925-26 which amounted to almost Rs. 12,00,000.

Future.—There seems every indication that the planting industry has an era of prosperity before it for at least some years to come. It will be noticed from the statistics of the importation of tea chests that the value of imports has been increasing steadily from year to year and the demand must increase in the future for boxes of all kinds.

48. *Constructional timbers—Present.*—The planting industry may be said to absorb very little timber for constructional purposes from sources other than that obtained off its own estates. This may be explained by the difficulties of transport from the plains to the hills. There are many new factories now being erected, but these are almost entirely of steel girder construction although wooden floors and partitions are required.

Future.—With improved trade possibilities, the planting industry will require a fair quantity of timber but only in scantling and board form for partitions, floors, etc. A considerable trade could be built up.

Other important demands.

49. MISCELLANEOUS DEMANDS.—Other important demands, which are in existence and which show promise, may be classified under the headings of—

(a) Harbour works,
(b) Boxes,
(c) Ordinary building construction,
(d) Mouldings.

50. *Harbour works.*—No real survey has yet been undertaken to ascertain the demands for timber in this connection. That such demands do exist is apparent from the tenders which are called for from time to time for sleepers for harbour railways and also timber for buildings. At present on the East Coast such supplies have been made with imported timber owing to facilities for obtaining the same. With the works of improvement which are now being projected at many harbours, the demands for timber must increase.

51. *Boxes.*—The demand for boxes of all descriptions is steadily growing in Madras. Such concerns as the Standard Oil Company require very large quantities every year, and these supplies are at present being met from Singapore and other overseas sources. With the natural development which is taking place in South India, trade conditions are bound to improve, and, with it, the demand for boxes. At present the majority of boxes used in the different trades in the eastern sections of the Presidency are built up of old packing cases and, as a result, have a bad appearance and are unsatisfactory. This is necessitated by the absence of any source of supply of new and cheap packing cases and boxes.

52. *Ordinary building construction.*—No figures are available to show the annual consumption of timber used in ordinary building construction, but it may be assumed that the majority of timber produced from the Presidency forests—both private and State owned—is thus utilized. It may be assumed also that this demand must increase. India at the present time has a per capita consumption per annum less than any other big country in the world. Statistics show that

the most progressive countries have the largest per capita consumption and it may be safely assumed that this consumption in India must increase to an enormous extent as living conditions, trade and prosperity increase.

53. *Mouldings.*—The average annual imports for the five years ending 31st March 1926 show that over Rs. 1,00,000 of mouldings are imported every year. This is rather a surprising figure, but it illustrates a very possible market for many of our own timbers and is one which is almost certain to expand with better housing and living conditions.

F. Forest Engineering Branch—What it has accomplished.

Origination.

54. Proposals to create an organization that could cope with the many difficult problems arising in connection with the endeavours of the Forest Department to secure a fuller utilization of the vast timber resources of Madras were first presented to the Legislative Council in 1922. In March 1923, G.O. No. 340 (Development) was issued, accepting the proposals to organize a separate Engineering Branch of the Forest Department and engaging Mr. C. S. Martin, Consulting Forest Engineer to the Government of India as Chief Forest Engineer for a period of three years. He was at the same time deputed to select, in America, an expert in logging (extraction), sawmilling, and advance planning and organization of lumbering operations to fill the post of Logging Engineer. In October 1923, Mr. Martin arrived in Madras, together with Mr. J. Kenneth Pearce, who was engaged as Logging Engineer on a two-year agreement. A survey of the situation and the formulating of a preliminary organization was first taken up. The general policy undertaken was first to place existing exploitation operations on a stable and efficient basis, and to secure detailed and accurate information which would enable comprehensive operation plans to be laid down in advance and preclude costly mistakes being made, before recommending any new operation.

Initial policy.

Chenat Nair found in discouraging condition.

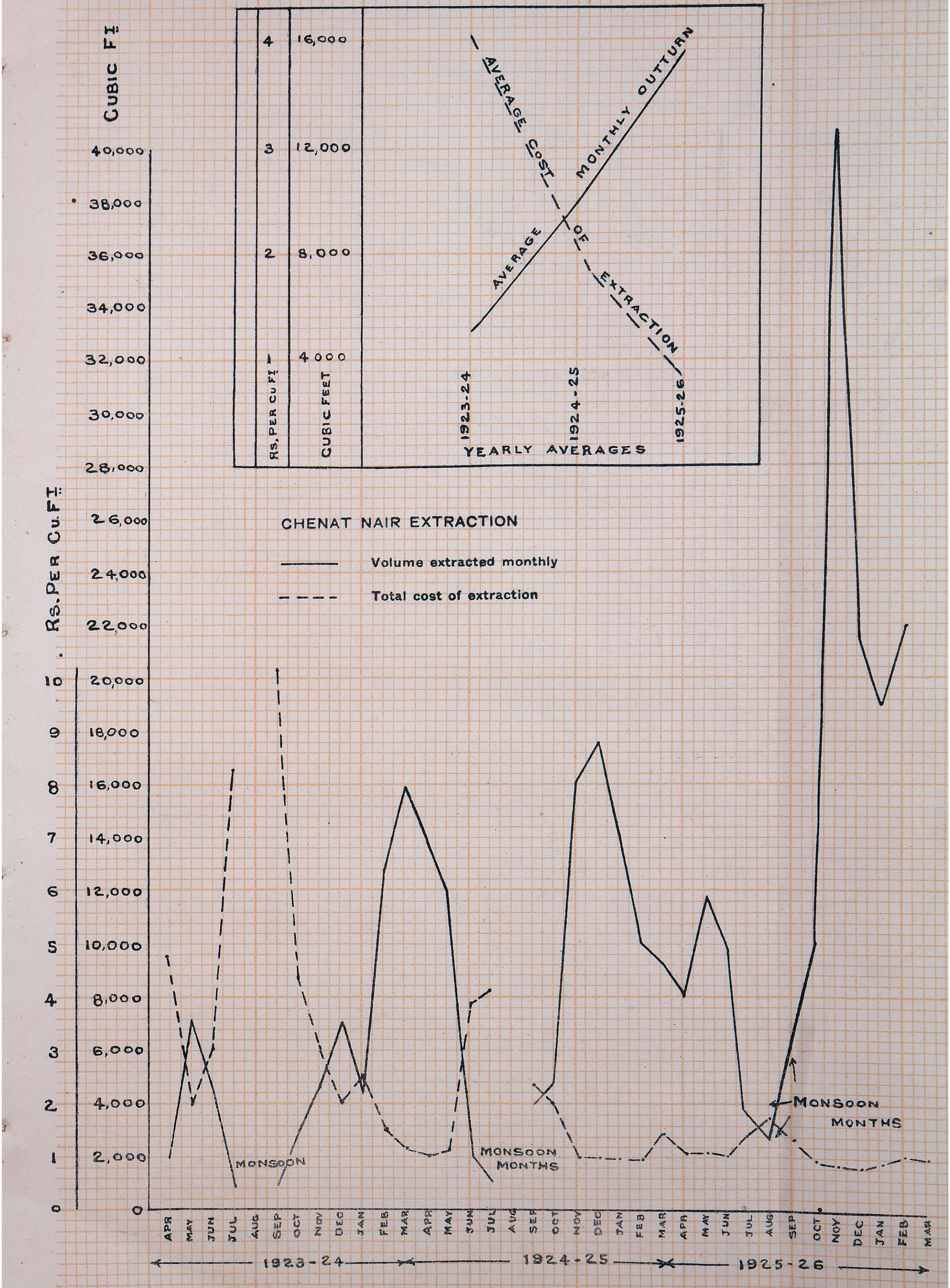
55. The Chenat Nair exploitation operation, which had been started years before by the regular forest staff, was found in a most discouraging condition. This operation had been started with the expectation that the entire log outturn would be absorbed by the Kolar Gold Fields, but many of the evergreen timbers comprising the stand in that reserve were unsuitable for use in the mines, and a slump in timber prices made teak and similar well-known timbers available for Kolar at less than their real value with the result that no market existed for logs of unknown species.

Sawmill only solution of evergreen timber marketing problem.

56. The only possible way to market the unknown woods comprising most of the evergreen forests, was to furnish the consumers with sawn and fully seasoned material. Accordingly, plans for a saw mill and box factory with three modified Sturtevent dry kilns were drawn up. This proposal was approved by Government and funds provided in 1924-25 budget. Owing to delay in the arrival of the machinery from England, the saw mill could not be erected until the end of that fiscal year.

Improvements in Chenat Nair extraction.

57. One of the first tasks attempted by the newly formed Forest Engineering Branch was to reduce the cost of logging (extraction) and increase the outturn from Chenat Nair forest. The extraction in Dhoni Valley was organized by the Logging Engineer and new methods introduced with the result that production was increased from 2,607 cubic feet in October to 16,088 cubic feet in March, and book costs decreased from Rs. 4-14-1 per cubic foot in October to Rs. 1-6-3 per cubic foot in March. Captain H. A. Irwin was Forest Exploitation Officer in resident charge, which post he had held prior to the formation of the Forest Engineering Branch. In April 1924, Major W. F. Chipp, who had been engaged in forest exploitation in the Punjab, joined the Forest Engineering Branch and was later placed in charge of the Chenat Nair Exploitation Division, Captain Irwin being made Forest Engineer in charge of Roads, Buildings, etc. Improved equipment in the form of a 2-drum Fordson Skidder was added in 1924, and one of the two old tractors purchased previous to 1923 disposed of.


CUBIC FT.
Rs. PER CU. FT.
4
3
2
1
16,000
12,000
8,000
4000
Rs. PER CU FT
CUBIC FEET
AVERAGE COST OF EXTRACTION
AVERAGE MONTHLY OUTTURN
1923-24
1924-25
1925-26
YEARLY AVERAGES
CHENAT NAIR EXTRACTION
Volume extracted monthly
Total cost of extraction
MONSOON
MONSOON MONTHS
MONSOON MONTHS
40,000
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
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APR
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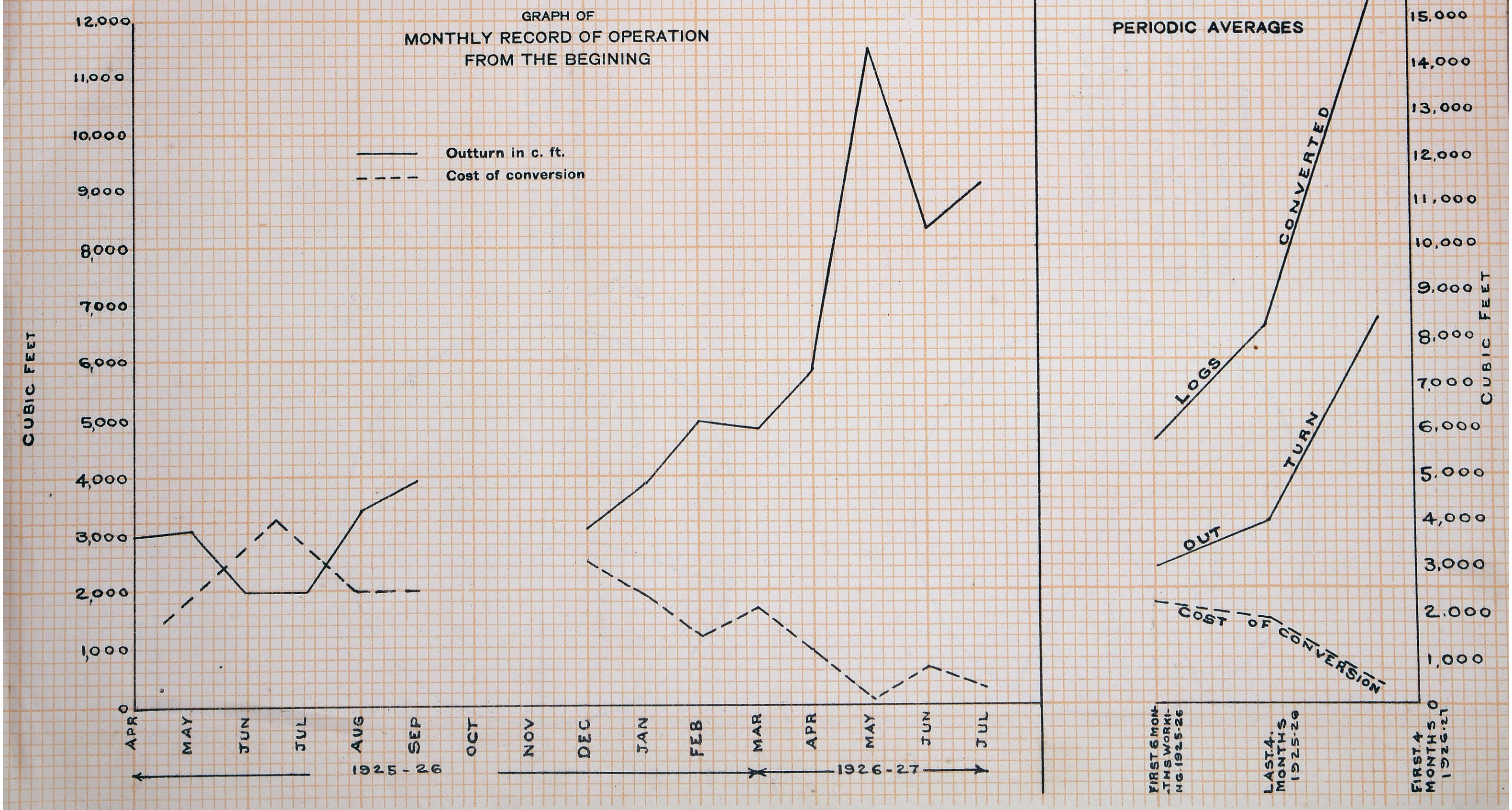
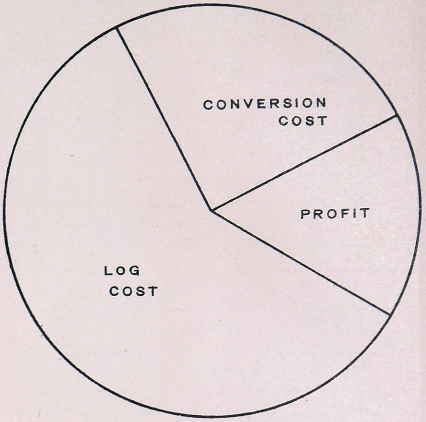
1923-24
1924-25
1925-26

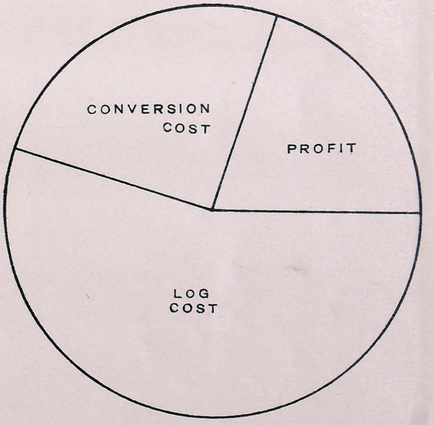
OLAVAKKOT SAWMILL (Chenat Nair Exploitation Division)



GRAPHIC REPRESENTATIONS OF RESULTS ON SELLING A SAWN & SEASONED AVERAGE EVERGREEN WOOD, FORMERLY COMMERCIALLY UNKNOWN, BASED ON CHENAT NAIR 1925-26 AVERAGE LOGGING COST AND 1926 OLAVAKOT SAWMILL COSTS WITH 54% CONVERSION.



RESULTS WITH SAME WOOD AND SAME COSTS, BUT 64% CONVERSION EXPECTED WITH FRESH LOGS.



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Copies 250

Helio- Zinco., Survey Office, Madras.
1926.

58. In 1925, the logging operations were moved from Dhoni to Sappal Valley. This area had been mapped and cruised by the Logging Engineering Division and operation plans prepared in advance. The value of the work was reflected in extraction costs which were reduced to as low as As. 12-6 per cubic foot one month (including all overheads) with a yearly average of As. 15-6 per cubic foot delivered at the saw mill. This was effected in country too rough and broken and precipitous for hand or animal logging methods to be used at all, much less at a competitive cost! Average monthly outturn doubled that of the preceding year, yet only two logging engines were used as against three required in Dhoni Valley. During the latter part of 1925 an average outturn of 1,000 cubic feet was maintained for 100 days. As will be observed in the accompanying graphic charts, steady progress, despite seasonal variations, has been made both in increased outturn and decreased cost, since the inception of the Forest Engineering Branch. We have proved mechanical logging in South India a success.

Mechanical extraction proved a success.

59. The Olavakkot saw mill started operating in April 1923, the first two months being occupied in training the entire labour force and cutting stock sizes. At first, the only orders received were for a few well-known species. Then as orders began to come in for new timbers which consumers had been persuaded to try, a gear wheel driving the head band saw broke. A new wheel was ordered from England; and meantime (after two months) a temporary one was obtained locally, but with the latter only a small quantity of the softest timbers could be sawn. Consequently, the whole saw mill had to run "light" until the new gear wheel arrived late in February 1926. The mill has operated steadily ever since, and the constantly increasing volume of orders has necessitated putting on a second shift of workmen.

Olavakkot saw mill.

60. During 1925-26 the mill converted 68,497 cubic feet of logs, giving 52 per cent outturn. During the first five months of 1926-27, 79,004 cubic feet of logs have been converted giving an outturn of 42,687 cubic feet of sawn material, or 54 per cent conversion. In considering conversion percentages it must be remembered that 40 per cent of the logs sawn had been lying in the depot for a considerable time pending the erection of the mill, and full capacity working, and had deteriorated badly so that much wastage in cutting resulted. We are now getting the depot cleared out of old logs, and in the future it is expected that the fresh stocks supplied to the mill will result in an appreciable improvement in conversion figures, which means lower cost of production and greater profits as shown in the accompanying graphs.

Improvement in conversion with fresh logs.

61. The three dry kilns have operated very successfully and we have been able to season practically all species. It is the kiln seasoning which makes evergreen softwoods (so called "jungle woods") a saleable product. The kiln seasoning cost averages 6 annas per cubic foot of which the salary of the kiln expert engaged from Dehra Dun amounts to 2 annas. With an additional battery of dry kilns, which are badly needed to supply the demand for fully seasoned timbers, the high overhead charges will be reduced. The same technical staff which is required for three kilns could look after 30. The total quantity kiln dried during 1925-26 was 25,000 cubic feet.

Kiln drying (artificial seasoning).

62. With logs delivered at the mill for Rs. * per cubic foot (average for 1925-26) sawing, seasoning and handling, costing Rs. * (average for first four months of 1926-27), and with 54 per cent conversion, the total cost of saw mill outturn is Rs. * These costs are based on commercial accounting practice and include all overheads, depreciation on machinery, etc. The prices received vary from Rs. 2-8-0 to Rs. 4-0-0, depending on the species and class or size of material produced. Some few new species are sold at less than cost to introduce them on the market and encourage their use. The accompanying graph depicts what is judged to be an average. It shows the present situation as regards one of the hitherto commercially unknown timbers which we have established on the market, selling at an average price of Rs. * and making a profit of 19.5 per cent. With the expected increase of 10 per cent in conversion and with the same extraction and

* Cost figures given in confidential supplement to this report.

conversion costs anticipated, the same average timbers will show a profit of 34 per cent. Actually costs themselves will decrease with increased production as the saw overhead charges are distributed over more cubic feet. That the average curve of production is steadily increasing and that costs are on the down grade is clear from the graphs of monthly outturn.

Outturn steadily increasing—Costs steadily decreasing.

63. The Chenat Nair Exploitation Division was established expressly as a commercial experiment to log, convert and market shola timbers, i.e., the timbers of the evergreen forests concerning which very little has hitherto been known. A few species were known in the timber market, but, generally speaking, shola timbers were considered by the local traders as jungle woods of poor quality and they will not purchase them in log except at ridiculously low prices. It is the object of the division to deal with these timbers and present them to the market in such form as will bring the best price. How far this has been done is shown below.

Object of Chenat Nair Exploitation Division.

64. In the first place, known timbers such as Terminalia tomentosa and Paniculata, Xylia xylocarpus, Mesua ferrea, Hopea parviflora, have been disposed of at favourable rates of about Rs. 2-8-0 to Rs. 3-0-0 per cubic foot in scantling or sleepers as demand arises. White cedar (Dysoxolum malabaricum) planks have realised from Rs. 4-0-0 to Rs. 4-8-0 per cubic foot.

65. Among the lesser known jungle wood species the greatest success has been obtained with Acrocarpus fraxinifolius for which there is now a demand greater than we can supply. Prices in scantling form vary from Rs. 2-12-0 to Rs. 4-0-0 per cubic foot. At a recent sale, two average logs realised Rs. 2 per cubic foot. In addition, Calophylum tomontossum has been placed before the market with success, both as building scantling and for reinforced concrete work. The price varies from Rs. 2-12-0 to Rs. 3-8-0 per cubic foot. The timber has been used also for motor bodies. It may be mentioned that pieces 22′ × 18″ × 2″ have been tried with success as moulds for railway signal posts. Lagerstoemia lanceolata found a strong market in Madras for motor bus bodies, but unfortunately supplies were not sufficient for the demand. Grewia tiliaefolia has been used successfully for door frames. Other species dealt with successfully are Pterospermum rubiginosum, Dichospsis elliptica, Homalium zeylanicum. Species which have been introduced at low prices to get them tested are Sterculia elata (for concrete moulds) and Bischofia javanica (for construction purposes).

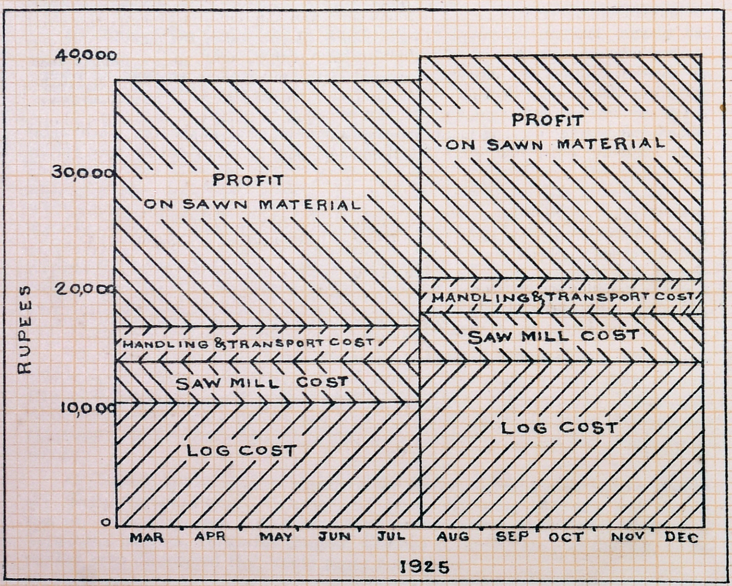
What has been accomplished in marketing hitherto unknown evergreen timbers.

66. *Soft woods.*—The known boxwoods, Bombax malabaricum, Tetramelis nudiflora and Alstonia scholaris, are marketed in the form of kiln dried boxes. Two first-class woods were discovered in Polyalthia fragrans and Elaecarpus tuberculatus about nine months ago and all depot stocks of these timbers are exhausted. Box timbers are being sold at Rs. 2-8-0 per cubic foot made up in shooks.

67. Second quality timbers placed on the market during the past three months are Holigarna arnottiana, Canarium strictum, Myristica attenuata and Litasea species. Advantage has been taken of an active market to sell such timbers as Terminalia belerica, Diospyrus insignis, Eugenia gardneri, etc., in the log, as no use has been discovered that would repay conversion.

68. Although the auditors' report on the financial results of the Chenat Nair Exploitation division for 1925-26 is not yet received at time of writing, it is certain to show a loss. This loss is entirely because large stock of logs could not be disposed of, and simply lay in the depot and deteriorated until they had to be sold as fuel. Owing to delay in the arrival of the saw mill machinery and the unfortunate breaking of the main driving gear wheel, necessitating restricted running as already explained, the mill could take in only a fraction of the logs extracted to supply it. The timber which actually went through the mill was all sold, and, on the average, at a profit. The loss was sustained in having to sell as fuel at Re. 0-1-6 a cubic foot, timber which cost Re. 0-14-6 to extract, and which log buyers would not take. It might be asked, "Why extract those logs;

GRAPH OF
MANUFACTURING AND TRADING ACCOUNTS
OF
BEYPORE PORTABLE SAW MILL



why not leave them in the forest?" The answer is that, if we did not make them available to purchasers, we would never develop a market for the evergreen timbers. We would never have got timber merchants to take Terminalia belerica and Eugenia gardneri if we had not had the logs in the depot to see, and we would never have created the demand which is now greater than we can supply for Polyalthia fragrans, Acrocarpus fraxinifolius and others, if we had left them standing in the forest. Every month finds new use for a new species and though we could make a greater present profit by leaving the unknown species, we would never attain our goal of popularising evergreen timbers and increasing by crores the value of the vast evergreen forests of Madras if we followed such a short-sighted policy.

69. A reference to the graphs of average outturn will show that the saw mill is now absorbing the entire log output—saw mill log requirements balancing extraction. This, and the steadily increasing demand we have created by placing a perfectly seasoned, finished material on the market, makes prospects for profits in 1926-27 and the future bright indeed.

Beypore saw mill.

70. The Chief Forest Engineer in June 1924 proposed the installation of a portable saw mill at Beypore to cut up the large surplus stocks of logs which had accumulated in the Beypore Depot (owing to selected logs only being purchased at the auctions); the surplus stocks of inferior logs to be converted into sleepers, and side cuts into boards and scantlings, and slabs into reepers. In November the Legislative Council sanctioned a supplementary grant of Rs. 12,000 to meet capital cost and running charges of the saw mill for the current year. The saw mill was erected by the Logging Engineer, Madras, in February 1925, and was operated as a part of the Nilambur Commercial Forest scheme, under the technical supervision of the Forest Engineering Branch. The manufacturing and trading accounts, based on cost of logs delivered at the mill, show the following financial results on the saw mill:—

For the period March to 4th August 1925.

	RS.	A.	P.		RS.	A.	P.
Cost of logs	11,268	14	3	Revenue from sawn material.	38,080	5	5
Cost of running saw mill (includes overheads) ...	3,346	9	0				
Handling and transport sawn material to market	2,928	8	7				
Total cost ...	17,543	15	10				
Profit ...	20,536	6	7				
Total ...	38,080	5	5		38,080	5	5

For the period 5*th August* 1925 *to* 31*st December* 1925.

	RS.	A.	P.		RS.	A.	P.
Cost of logs	13,882	7	5	Revenue from sawn material.	40,075	11	8
Cost of running saw mill (including overheads)	4,529	6	4				
Handling and transport of sawn material to markets	2,775	1	1				
Total cost ...	21,186	14	10				
Profit ...	18,888	12	10				
Total ...	40,075	11	8		40,075	11	8

No data is yet available for this year.

Up to 31st December 1925 the total capital invested in saw mill plant and was only Rs. 14,134. In the first ten months of its operation the saw mill made a profit of Rs. 39,425-3-5. It therefore paid for itself in $3\frac{1}{2}$ months. It also

made additional profits for the log depot, as the buying ring realised that if fair prices were not offered, the logs would be disposed of to the mill. A general higher level of log prices was the result.

Indications for Olavakkot.

71. The output of Beypore is principally teak, a well-known timber readily saleable in sawn form. The Olavakkot accounts would have told a similar tale of profits had all the commercially unknown evergreen species extracted from Chenat Nair been saleable. The results from the Beypore mill give some indication of what can be expected from Olavakkot with the increased utilization of hitherto unused timbers.

The Beypore depot and saw mill was taken over entirely by the Forest Engineering Branch on 1st September 1926 and more efficient working and much better financial results are anticipated.

New portable saw mills.

72. The Railway Sleeper Pool, Southern Group, having offered to take all the sleepers we could supply of certain species (Hopea, Mesua, Xylia, Teak, Karimuradu), proposals were made by the Forest Engineering Branch to purchase three portable saw mills and were sanctioned by Government in November 1925. The first saw mill was erected at the Mount Stuart Forests Log Depot at Pollachi and started commercial work in July 1926, after a fortnight period of training operating staff. The mill could have started six weeks earlier had not the shafting and pulleys been lost in transit.

73. The starting of the other two mills was held up by the failure of the manufacturers in England to ship the power plants for running the mills as promised. Steam engines for the Chedleth mill in the Wynad were finally obtained locally and at time of writing the saw mill is ready for operation but awaiting the boiler inspector.

The third mill, erected at Parappa in South Mangalore division, South Kanara, is still waiting at time of writing (September 1926) for the engine which was ordered from England in November 1925.

74. These mills are of the same type as the one successfully operating at Beypore, but of heavier construction and greater capacity so that even better results are expected. The Beypore Mill was powered with internal combustion engines because of low initial cost, but the operating cost of the new steam powered mills, burning sawing waste, will be less. The Pollachi and Parappa Mills will probably have an annual capacity of 60,000 cubic feet, while from Chedleth Mill operating under more difficult conditions as regards labour supply, 50,000 cubic feet per annum is expected. Sawing of special orders for Railways and Government departments is becoming an increasingly important function of the portable saw mills.

The policy being followed.

75. The policy of selling the better quality logs which pay a profit in log form, and of sawing the surplus and inferior logs in the mill is being followed. The local timber merchants are thereby provided with their usual log supply, and the economic balance maintained.

76. The saw mills and depots are being operated by the Forest Engineering Branch, the former being under the Forest Engineer-in-charge, Saw Mills and Extraction, and the latter under the Forest Utilization Officer who is directing all log and lumber sales.

77. Mr. J. A. Wilson, Deputy Conservator of Forests, was posted for training in Forest Exploitation in December 1925 and took charge of the Chenat Nair Exploitation division in April 1926, Major Chipp being made Forest Engineer-in-charge of the newly formed Saw mills and Extraction division, made necessary by the establishment of the three new portable saw mills at Pollachi, Chedleth and Parappa, and the taking over of entire control of Beypore saw mill by the Forest Engineering Branch.

Logging Engineering.

78. Logging engineering or the planning in advance for forest exploitation operations is of fundamental importance, and a prerequisite to a successful operation.

A "cruise" or an enumeration of the stand of timber, giving the amount of each species by small units of area, and, in rough mountainous country with steep slopes such as the Western Ghats, an accurate large scale map are the first essentials. With this data, the best logging methods are determined, transport routes laid out, costly mistakes anticipated and avoided and the whole operation efficiently organized.

Mapping and cruising.

79. Methods were developed by the Logging Engineer, Officers, Rangers and Foresters trained and the mapping and cruising of 13,557 acres of timber forests completed by August 1925, the date of expiry of Mr Pearce's first agreement. The following were the areas covered :—

Forest Reserves.	Character.	Acres mapped and cruised.
Chenat Nair Reserve—		
Dhoni Valley	Evergreen	300
Sappal Valley	"	508
Elival Valley	Evergreen and mixed deciduous.	3,000
Nellikutta (Nilambur)	Deciduous	1,539
Nalkur (South Kanara)	"	960
Someshwar (South Kanara)	Evergreen	7,000
Tekkadi (Mount Stuart)	Deciduous	250

In addition, 22 miles of railway line and 8½ miles of flume line were surveyed in Tinnevelly (Papanasam reserved forest) by the Logging Engineering division.

Other work.

While directing the above work, and training the new men as the staff was increased, the Logging Engineer was also engaged in giving technical advice to the officers in charge of exploitation operations, erecting new logging machinery and the Beypore saw mill and training operating crews, lecturing at the Madras Forest College, and making extensive reconnaissance of the forest areas in which development was proposed or anticipated

80. Mr. P. W. Davis, Assistant Conservator and Working Plans Officer, was in charge of monsoon office work of the Logging Engineering division from 14th August to the end of September and then of field work until 31st March 1926. During this period 1,017 acres were mapped and cruised in Kal Ar Reserve, Anamalais, 1,403 acres in Kallidekode area (Chenat Nair reserve) and 2,000 acres in Someshwar; 30 miles of traverse line along the boundary of the reed area in Papanasam reserved forest was run.

81. Mr. Pearce returned to Madras on a new agreement on 22nd February 1926, and resumed charge on 1st April. The break of the monsoon in June found the following field work completed in addition to that given in paragraph 79 :—

Forest Reserve.	Character.	Acres mapped and cruised.
Karian Shola (Mount Stuart)	Evergreen	1,712
Kallidikode (Chenat Nair) ...	"	1,403 *
Kal Ar (Anamalais) ...	"	1,017
Someshwar	"	4,400 *
Papanasam	Reed area	42 miles of traverse embracing total reed area of 20,000 acres.

* This completes the mapping and cruising Someshwar and Chenat Nair Reserves.

Office compilation of cruise data and topographic and cover maps for all the areas will, it is anticipated, be completed in September 1926.

Valparai sleeper project.

82. In June 1925, the Logging Engineer recommended exploiting the forest area in Kal Ar Valley, Anamalais, South Coimbatore, which is being cleared and planted by the Cinchona department. A detailed report was submitted, and Rs. 31,300 was provided in the 1926-27 budget for the project, and a profit of Rs. 20,875 anticipated on the basis of the Logging Engineer's estimate. As no other agency was available, the Logging

Engineering division undertook the work. A Logging Engineering Ranger was placed in charge with two Foresters, one for the necessary road works connected with the project and the other for extraction supervision. The work will be completed by 31st December, and judged by the working costs up to the end of September, the profit will be Rs. 21,372, or 68 per cent on Government's investment in the project.

83. When Mr. Pearce became Chief Forest Engineer in August 1926, Mr. B. A. Cariapa, an Extra Assistant Conservator of Forests, who had served in the Logging Engineering division since its inception, was appointed to act as Logging Engineer.

The Forest Utilization division.

84. As far back as 1919, the Forest Department realized the importance of having an officer specially appointed to investigate markets and to endeavour to develop markets for forest produce, and, although an appointment was made, very little work was done owing to lack of staff and organization. However, in May 1923, Government realised the increasing importance of this branch of development and appointed Mr. T. Clear as Forest Utilization Officer, Madras, with headquarters in Madras. The value of this appointment was felt in the organizing of the consigning of shipments of timber and the collection of the exhibits for the British Empire Exhibition in 1923.

85. But the real beginning of any definite programme of utilization may be said to have started with the formation of the Forest Engineering Branch in October 1923, of which the Forest Utilization office formed a recognized unit. In December 1923, Mr. J. W. K. Wernham, Deputy Conservator of Forests, was appointed Forest Utilization Officer, and immediately steps were taken to fulfil the role which had been allotted to the Branch. This involved—

(a) The collection of data connected with actual and potential markets.

(b) The investigation of the possibility of joint Government and private enterprises.

(c) The investigation of special processes necessary to the full utilization of timber and other forest produce, such as seasoning, preservative treatment, pulp manufacture, etc.

(d) The control and co-ordination of sales.

86. The results obtained can most fittingly be expressed by an extract taken from the report of the Chief Forest Engineer on the work done by the Forest Engineering Branch up to March 1924—

"*Forest Utilization.*—The scope of the work coming under this department has increased so rapidly under the direction of Mr. Wernham that it is difficult to cover the ground in a brief report of this nature. This work must be rapidly expanded if we are to realise anything like the benefits now made possible by the organization of the Forest Engineering Branch of the department."

Problems handled by Forest Utilization Officer.

87. A few of the problems then being handled by the Forest Utilization Officer were—

(a) Collection of data on existing markets.

(b) Collection of data on available supplies of raw material, quantities, availability, cost of extraction, etc.

(c) Sleeper supply to the railways.

(d) Export of timber to the European market.

(e) Collection of data on Madras timbers and their uses.

(f) Establishment of and co-operation, Forest industries—Bobbins and spindles, handles and turnery, paper pulp, matches, pencils, boxes.

(g) Minor Forest Product—Collection, utilization and markets.

(h) Grading of timber.

(i) Organization of fuel supply.

(j) Research and timber testing.

88. By June 1924 the work had become too heavy to be handled by one officer, and Mr. M. F. Bridge, Deputy Conservator of Forests, was posted to Madras to take over all such work connected with the collection and issuing of statistics, propaganda, and the organization and co-ordination of research work. This post, called the Forest Economist, was definitely sanctioned in February 1925 and was placed directly under the Chief Forest Engineer. At the same time, all work dealing with minor forest products was placed under an Assistant Forest Utilization Officer (now the Deputy Forest Utilization Officer) working under the Forest Utilization Officer. Mr. Abdul Hafiz has held this post since its inception.

Forest Economist and Minor Forest Products Officer.

89. In July 1924, Mr. Wernham was deputed to America for 18 months' deputation to study utilization and marketing, which period was later extended to 21 months to enable Mr. Wernham to visit England, the Philippines, and the Federated Malay States to look into markets and forest conditions ruling in those countries. Mr. H. P. Ward assumed charge of the Utilization Branch until Mr. Wernham's return in March 1926. During that period, the original programme of work was thoroughly stabilized and the ground work consolidated. Much useful work was done in the way of organizing a substantial supply of sleepers to the railways, of building up the box industry from the Olavakkot mill, and in getting private firms and individuals interested in our almost unknown timbers.

90. With Mr. Wernham's return, the work of the branch received fresh impetus. Coinciding as it did with the beginning of operations proper of the first of the new portable saw mills—that at Beypore—many new problems had to be faced and solved. Such questions as price lists, standardization of sizes to be cut based on market requirements, introduction of grading rules, and the disposal of the complete outturn from the mill, all required urgent attention. The urgency of these items were all the more emphasized with the opening up of saw mill operations at Pollachi Depot and the installation of mills at Parappa and Chedleth.

91. Co-ordination is essential and, with the growing number of log and sawn timber depots coming under the Forest Utilization Officer, a separate Forest Utilization Depot, division under the Forest Utilization Officer assisted by a newly appointed Assistant Forest Utilization Officer has been sanctioned as from 2nd August 1926. This organization allows for the grouping of material from several depots to meet large tenders called for from the railways, etc., to arrange sawing orders and supplies on indents, to consolidate bills and accounts and to regulate prices. It enables grading to be uniform and the outturn of the mill to be disposed of in the most profitable markets.

Constitution of Utilization Depot division.

92. Grading rules for sawn teak have already been drawn up. Price lists for teak and other species from Beypore and Pollachi have been complied, specifications of standard sizes to be sawn in the mills have been issued, and arrangements have been made to market and dispose of all the outturn from the mills. This latter has been effected on the lines of cutting to special orders as far as possible and then converting all the remaining material into standard stock sizes. These standard stock sizes are being distributed under contract to different market centres under the direction of a private agency. This should ensure the complete disposal of all the outturn of the mills and thus enable mass production to result.

93. The Minor Forest Product section has also carried out valuable work in the collection of information and statistics as regards the Minor Forest products of the Presidency. The Deputy Forest Utilization Officer during his tours has gathered much first hand information and has attended local sales and assisted local officers with his technical knowledge. It is intended in the near future to embody all available data on each product in the form of technical-commercial bulletins for publication and distribution.

Minor forest produce.

94. Up to the present, the Utilization Office has acted simply as a means of bringing the several districts into touch with markets, and it is thus impossible to state the actual volume of business which has resulted from its organization. In 1925-26, it actually obtained contracts or disposed of about Rs. $3\frac{1}{2}$ lakhs. From 1st April 1926 to 31st July 1926

New business obtained.

it had secured business amounting to over Rs. 3½ lakhs; so it is estimated that for the year 1926-27 the sum total will amount to about Rs. 6 lakhs. In 1927-28 the figure should reach Rs. 9 to 10 lakhs. The benefits of the organization are already becoming apparent. The grouping of the sources of supply and the co-ordination of prices on economic principles have already resulted in increased revenues, and as outside markets are developed, the one central organization can deal much more efficiently with the whole situation than a number of scattered districts whose officers have the other important forest duties to attend to.

95. However, with the increase of the area to be included in the field of marketing, spreading as it must over the whole Presidency to the other parts of India and also overseas, together with the intensification of exploitation and saw mill operations, it must be impressed that the staff of the Forest Utilization division must increase also and in due course it must become one of the most important units of the Forest Department. The future work of the division must consist of consolidating and strengthening the present organization, and then to pay special attention to grading and inspection, forest industries and overseas trade.

The need for Forest Economist.

96. Very soon after the formation of the Forest Utilization Branch, it was found that the work of the Forest Utilization Officer was being very severely handicapped in many directions by the lack of co-ordinated information about the various species of timber produced in the Madras forests, and about the requirements of the different timber using industries.

97. Up till this time only a very few species such as teak, rosewood, mathi, and three or four more were in common use and the timber industries had a very strong prejudice against the introduction of anything new. There is much risk involved in using a new species since it is not known whether it will season well, whether it has good working qualities, whether after being made up into the finished article it will warp, twist or crack, or whether it is liable to insect attack. "We cannot afford to experiment with it", they say in effect, "and, supposing it does prove satisfactory and after we have secured a market for it, can you promise a continuous supply?" Definite assurance is required on these points. What is wanted therefore is a fund of definite tabulated knowledge, about the qualities and quantities of all our timbers and especially our unmarketed shola species. It is one side of the Forest Economist's work to collect all the existing information, to add to it as further experiment widens our knowledge and to arrange for such experiments.

98. The work was started by Mr. Bridge in July 1924, and the post was confirmed on 2nd February 1925. Since that time the post has changed hands many times owing to Mr. Bridge being deputed to Dehra Dun for training, and later going on leave, but in spite of this discontinuity, a very considerable amount of useful work has been accomplished.

Forest Economist's work.

99. The Forest Economist's duties may conveniently be divided into the following headings :—

(1) Research, and the collection of data and statistics.
(2) Maintenance of records.
(3) Utilization of the information collected.

Co-operation with Dehra Dun.

100. *Research and the collection of data.*—Research as used here needs qualification. The Forest Economist has not the equipment or specialized training for laboratory research. His work is to deal with practical questions in the use of timber and, where research is necessary, to get the technical details done by those who are qualified to do it. And, in this, the Forest Economist has been working in close collaboration with the Forest Research Institute, Dehra Dun. Our timbers are being taken in the order of their importance, as judged by their availability, and by the present demands of the market, and are being sent up to Dehra Dun where they are tested fully under the various projects carried out by the Forest Economist, Dehra Dun. (A list of these is given in Appendix I.) In this way we are able to obtain complete and reliable information regarding the strength of our timbers, their hardness, compressibility, their suitability for sleepers, their durability, their amenability to antiseptic treatment, seasoning qualities, and so forth.

101. Again, research as used here covers such questions as the most economical usage of timber; for instance, how to make packing cases so that the maximum strength is obtained with the minimum expenditure of wood. How to nail boxes most efficiently and cheaply, etc. It is work that calls for a general knowledge of the qualities of timber and the timber using industries. Considerable progress has been made mainly owing to the cordial help received from Dehra Dun, but much time has been spent picking up information on the utilization of Indian timbers, as this side of forestry was not emphasized in our training.

Co-operation with private firms.

102. After these purely experimental data have been obtained, it then becomes necessary to test the timbers in actual practice; and, in this work, various firms and institutions have readily given us their help. It has been the policy to supply materials to the firms at cost price for testing for their own specific purposes, on condition that they in return let us have a full report on the suitability of the species provided. We also have samples made for firms departmentally, and sent to them for trial and report, and this has in several cases resulted in orders. A list of woods being tested by firms for special purposes is included in this report.

Research in Forest Department saw mills.

103. The departmental saw mills provide another source of information for the Forest Economist. A very great deal of experience in the best ways of cutting different timbers, how they behave in seasoning, how they degrade in the log, and how they stand up when used in construction works, etc., is gained there, which is very useful. The artificial seasoning kilns at Olavakkot Saw Mills also provide much of useful information on the seasoning properties, and the best methods of kiln drying different species. Urgent need exists for research in seasoning, both by natural and artificial methods. The present practice of cutting timber and stacking it in the log in depots often for considerable periods of time is iniquitous, as under these conditions most timbers degrade far more rapidly than they ever gained in value when growing in the forest. The damage, which is chiefly caused by exposure to the heat of the sun, by fungus attack and borers, will cause anything from about 5 to 75 per cent or more wastage in a log in a year, according to climatic conditions and species. The remedy for this is quick conversion and proper seasoning methods. Dehra Dun has instituted a kiln-seasoning project and invite us to send our woods up there to be tested, but this is very unsatisfactory on account of the *expense* of transport, the indeterminable effects of a long railway journey in open trucks under a tropical sun and through tropical rains, and on account of the long time that elapses before any results are received. What we require--and require urgently—is one or more seasoning kilns devoted entirely to experimental purposes. The present existing kilns are judged by commercial results, and are worked at top pressure the whole time, and therefore cannot be used for research work. The experimental kilns may be quite small in size, and the work done in them would follow the lines of the Dehra Dun specification (Project VII). In this way full results could be obtained on the seasoning qualities of our timbers, many of our more refractory timbers could safely be introduced into the market, and an enormous saving in wastage from degrade due to wrong seasoning method could be effected. The whole question of seasoning, both by natural and artificial methods is so large and so vitally important that it would pay to appoint a qualified officer specially to deal with it. The Forest Economist has not got time to do this work himself and it would keep an Imperial Officer fully occupied for several years, if not indefinitely. The financial saving effected after two or three years work would pay the expenses of the research many times over.

Need for experimental dry kilns.

Collection of statistics on supplies.

104. The Forest Economist is also engaged in the collection of statistics regarding the supplies of the various species available; this has only just been organized. For areas mapped and cruised by the Logging Engineering division complete reliable data are available, and, where working plans exist, these figures can be obtained fairly accurately, but in forests where there are no working plans, it is only possible to guess at the quantities available. This information is very important for many reasons, the chief of which

is that before a firm or a company place an order with the Forest Utilization Officer, they almost invariably enquire whether we can guarantee future supplies, and to what extent. The Forest Utilization Officer also requires to know where the different species are available and in what quantities, and the Forest Economist has to know what species must be tested first, and which may be left over till later.

Utilization Library.

105. Books, periodicals, and the current correspondence files of the Forest Utilization Officer and the Forest Economist form other very useful sources of information. One of the first works undertaken by the Forest Economist was the formation of a Utilization Library, and a large number of the very latest works on forest utilization subjects were obtained. Bulletins and the publications of the research results of Dehra Dun, the United States Forest Service, the United States Forest Products Laboratory, Madison, and many other foreign forestly departments, catalogues of wood-working machinery, etc., are received in the office and kept in the Library. A large number of periodicals are also received, and the Forest Economist goes through all these carefully, making cuttings and references on all subjects connected with forest utilization. It can thus be realized that a vast amount of technical and statistical information comes to hand, and is recorded according to the methods described below.

Ledger files.

106. All the information derived from research, and from the other sources mentioned above, is filed in "ledger files" and fully cross-referenced so as to be readily available. The ledger files are divided into two sections, viz., "species" ledger files and "subject" ledger files.

107. A species ledger file is maintained for every species of tree utilized in the Presidency, whether for timber or for minor products. Over 200 of these have been opened up to date, and in them statistics are kept regarding the quantities of each species available, their properties and uses, the result of test done on them, their markets, prices, and demand, and any other information that has any bearing on the utilization of the respective species.

108. Subject ledger files are kept under such headings as matches, pencils, carpentry woods, veneers, cotton bobbins, glues, markets, imports, etc., and at present we have 58 of these on our lists (see Appendix). Whenever information on a new subject comes to hand, a new ledger file is opened to receive it. The ledger filing work however has not been able to keep pace with the amount of information coming into the office owing to the fact that the Forest Economist has only one clerk who is fully occupied in dealing with correspondence and current matters. The need of a ledger filing clerk who could at the same time look after the library and the museum specimens is badly felt. Since it is at present impossible to extract all the information from the books and papers that come into the office, references are kept, so that none of the information may be lost, and when sufficient staff becomes available, it may be extracted and filed properly. Each ledger file will have to be gone through and edited and properly arranged, so that the information contained in them may be readily available.

109. Catalogues of the books and pamphlets in the library are maintained. Lists of all Government publications and publications of foreign departments and research institutes are also obtained and all useful books and bulletins purchased, so that the library is kept up to date.

Utilizing Information collected.

110. In the utilization of the information collected the Forest Economist and the Forest Utilization Officer have to work in very close co-operation, and it is often difficult to define where the Forest Economist's work ends and the Forest Utilization Officer's work begins. In general, however, the following headings came under the Forest Economist's department :—

(a) Propaganda work,
(b) Answering trade enquiries,
(c) Identification of woods;

while in the matter of investigating trade possibilities, new markets, and so forth, the Forest Uilization Officer works jointly with the Forest Economist.

111. The wide advertising of our timbers, their properties and possibilities is of the greatest importance in securing markets for our less known species. Up to the present, propaganda work has been done in three ways, viz.—

Advertising and propaganda.

(1) Publication of bulletins,
(2) Holding exhibitions,
(3) Personal visiting.

112. Four bulletins were published dealing with the working qualities, strengths and supplies of 17 species of timber trees. They were well received by the trade and brought in a number of enquiries.

Publication of bulletins.

Samples of boxes, planking and boxes were shown at the Industrial Exhibition held at the People's Park Fair from 22nd December 1925 to 1st January 1926. Although the time given for preparation was inadequate, the stall attracted considerable attention, and numerous enquiries were made.

113. The nucleus of a Forest Utilization Museum has been formed, and this will become very useful for propaganda and demonstration purposes. Large numbers of hand specimens have been obtained, and it is hoped shortly to have a complete collection of specimens of all Madras timbers. Comprehensive collections of specimens of the timbers of the Philippines and of the Malay States have also been received. But what is most important is to collect as many specimens as possible of *manufactured articles made of different Madras timbers*, and to use them for exhibition purposes, so as to show the timber consumers what our timbers are capable of being used for. A specimen that can be seen and handled is far more effective than any amount of statistics and reports. With this in view, it would be necessary either—

Forest Utilization Museum.

(1) to set up a small wood work shop which could draw its supplies from the Madras Timber Depot, or
(2) to come to an arrangement with some such institution as the Government School of Arts and Crafts.

The latter has the advantage of obtaining expert supervision combined with artistic imagination and would ensure our woods being displayed to the best advantage.

114. Personal visiting is by far the best form of propaganda, as one can interest the other party much more easily by this means than by any other. It also has the additional benefit that the visiting officer gains a great deal of experience of the requirements of the various trades. The Forest Economist has not had much time to go round inspecting wood-working industries and talking to the timber consumers, but the results from what visits he has been able to pay are very gratifying. It is intended to give more attention to this in future.

Personal visiting.

115. Considerable time is taken up in answering trade enquiries about the suitability of different woods for various purposes, what woods may be substituted for more expensive ones, what woods may be used to replace imported species, what supplies are necessary for starting various business enterprises, and where these supplies may be obtained, and so forth. Enquirers are given all information available that is likely to be of any use to them.

Trade enquiries.

To give an idea of the variety of subjects about which enquiries are received, the following subjects among many others have been touched on:—Tobacco barrels, pencils, matches, ship's fenders, panelling woods, packing cases, boxes of various kinds, tool handles, æroplane woods, picking sticks, gun stocks, end coatings for scantlings, boring by beetles, etc.

116. A certain number of specimens are received for identification, but at present this office is not properly equipped for this work, and Dehra Dun has to be consulted. This entails long delays before results are received. Since necessity for identification often arises in connexion with the mixing of inferior species with the correct species in an order

Identification of woods.

from a firm, it is most important that the department should be in a position to give an expert opinion without unnecessary delay if the case is taken to the courts. And still more is it necessary in order to protect our better woods. For it very frequently occurs that in a case of such an admixture the inferior species are not detected with the result that the good species are judged by the behaviour of the inferior substitute, and the price in consequence suffers. The question of establishing an identification and grading bureau has been dealt with elsewhere in this report, but it is a very important matter and one which is too large for the Forest Economist to tackle efficiently.

117. The Forest Economist's department is entirely a revenue spending department and one which is likely to extend and whose expenses will increase as time goes on, but there is no doubt at all that the value of the work, as judged by the new woods introduced or the market, the increased sales, and the assistance and advice given to many timber-using industries, is very great, and quite incommensurable with the expenditure incurred.

Does forest research pay?

The following excerpts from the decennial record of the United States Forest Products Laboratory give the answer to the question "Does it pay?" :—

Page 60.—"Investigations on the mechanical properties of American woods have given knowledge permitting a 20 per cent increase in allowable working stresses in structural timber. This means a possible saving of 40,000,000 dollars annually."

Page 60.—"Claims for loss and damage to commodities in shipment actually paid by the railwoods amount to over 100,000,000 dollars annually. Proper nailing and improved designs developed by the laboratory is estimated to save about 1 per cent of this loss, a total saving of 1,000,000 dollars a year. The importance of the knowledge which the laboratory had accumulated on suitable methods of drying and a dry kiln design at the beginning of the War cannot be estimated in dollars."

Page 61.—"Preventable losses in commercial operations due to improper air drying and poor kiln drying have aggregated annually over one billion dollars. How much of this is being saved through the assistance of the laboratory it is difficult to estimate, but the losses are obviously growing less . . . "

Note.—The losses in seasoning in India are even greater in proportion.

Page 61.—"Results of course cannot be obtained over night . . . however . . . over a reasonable period of years, economies resulting from organized research so greatly exceed the expense involved that there can be no question as to its value."

The Forest Engineer, Madras.

118. Construction of all important roads and buildings in Reserved Forests was taken over by Capt. H. A. Irwin, Forest Exploitation Officer, and was placed in charge of the work as Forest Engineer.

While the construction works carried on by the Forest Engineer, Madras, are not directly connected with exploitation, a resume of what has been accomplished is of interest inasmuch as it is one of the important activities of the Forest Engineering Branch.

1924-25.

Mount Stuart Ghat Road completed.

Do. damage (due to exceptional monsoon) repaired and

Olavakkot Saw Mill building and storage shed erected.

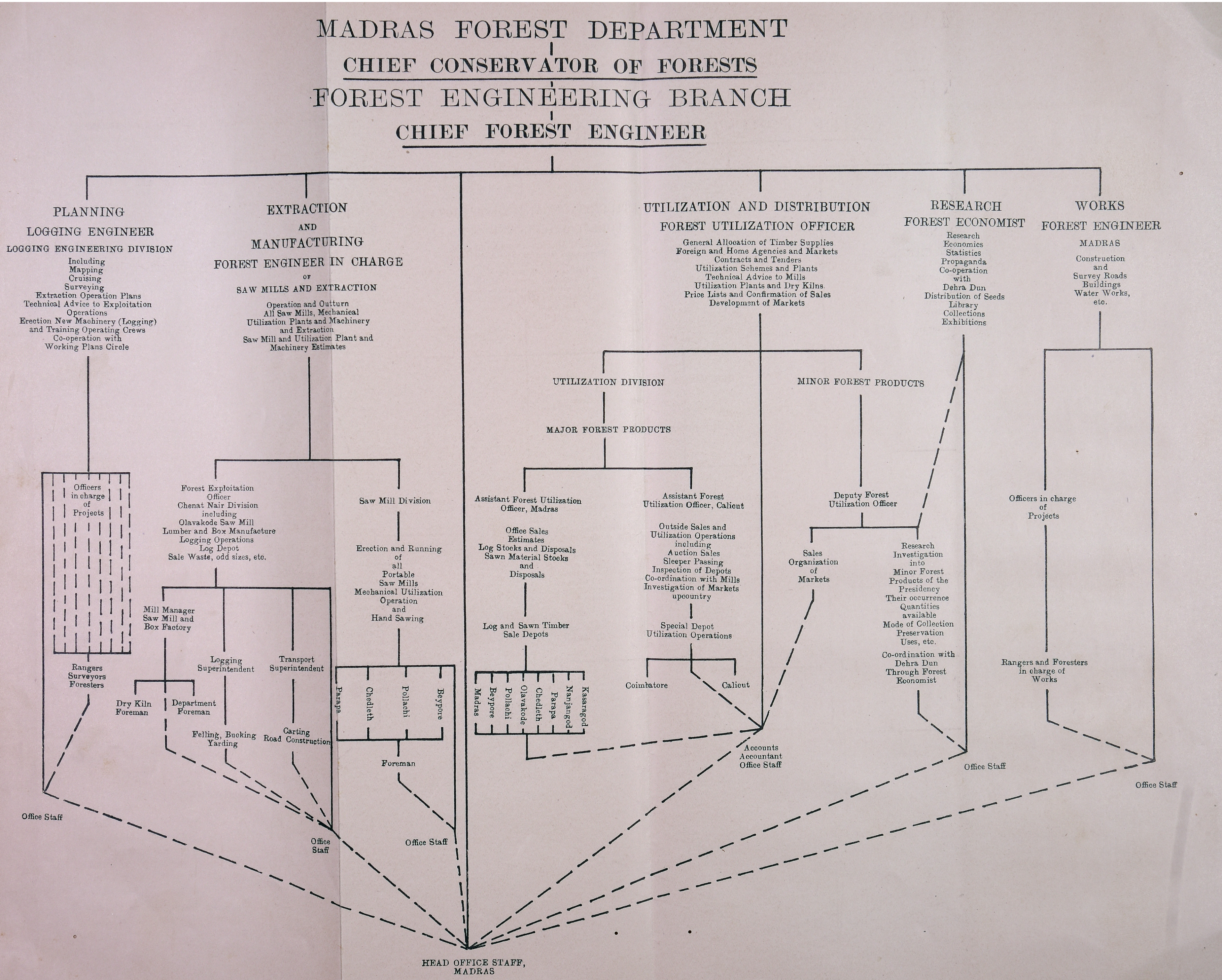
Olavakkot Saw Mill staff quarters built.

Top slip—Anaipadi and other road surveys made.

1925-26.

Top slip—Anaipadi road—

Earthwork, bridges and revetment completed—Expenditure Rs. 75,455.



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NOTE:—Reproduced from the original received from the Chief Forest Engineer, Madras.

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Officers' rest-house, two Rangers' quarters, Range office, three Officers' quarters, two Guards' quarters built.

	RS.
Amount sanctioned	54,000
Expenditure	47,[illegible]00
Water-works—Top slip	1,168
Suspension Foot Bridge, Kodamadi, Papanasam Forest	1,000
Metalling Mount Stuart Ghat road ...	16,820

Plans and estimates prepared for—

Two District Forest Officers' bungalows, Mangalore.

One District Forest Officer's bungalow, Kurnool.

Masonry Reservoir and pipe line water-supply, Top slip, Olavakkot-Elival road.

1926-27.

Construction of above bungalows and roads.

Consulting work.

119. The Chief Forest Engineer and the Logging Engineer have also done considerable work of a consulting nature. Technical reports to the Department of Industries on companies desiring loans, mechanical transport in the Nallamalais and Resellkonda, Cauvery-Mettur fuel supply, wire ropeways, mechanical logging for the Andaman Islands, Forest exploitation in Coorg, are some of the special consulting jobs.

Planning new developments.

Much advance planning and engineering of forest development projects, the results of which are not yet apparent, has been done. Chief among these is the Papanasam Forest Industries centre, to include a pulp and paper mill utilizing the great resource of hitherto valueless Eta reed, match factory, saw mill, veneer and ply plant, and subsidiary industries all hydro-electric powered.

A well-financed Northern Indian syndicate has now approached the Madras Government with offers to establish the pulp and paper mill and construct the hydro-electric plant. With the co-operation of other Government departments the success of Papanasam development is assured.

120. Another accomplishment of the Forest Engineering Branch of incalculable value is the successful introduction of the use of saws and wedges in felling trees and cutting them into log lengths. This has not only reduced the cost of felling and bucking from As. 1-6 per cubic foot of logs extracted (cost using axes alone) to 4 pies (using saws, wedges and axes) but has made a great saving in waste of raw material. When this method has been extended throughout the Presidency and applied to the felling and bucking of the some 50 lakhs cubic feet of logs cut annually, the economic gain will be tremendous.

Organization chart.

121. Attention is directed to the organization chart of the Forest Engineering Branch which illustrates graphically the present scope of the work, the duties and responsibilities of the various officers, and the lines along which the branch is administered.

Forest Engineering Branch has more than justified its existence.

122. After reading the preceding chapter on "The Forest Engineering Branch—what it has accomplished," no one can deny that the Forest Engineering Branch has more than justified its existence. With keen and energetic officers who have given everything to their work, under a progressive and far-sighted Chief Conservator, the Forest Engineering Branch has in very short space of time done much to increase the economic utilization of the vast forest resources of Madras, despite the obstacles opposed by uninformed critics and reactionary obstructionists. To quote an observant and unbiased outsider, Professor E. P. Stebbing of Edinburgh University, in Volume III of "The Forests of India", the official history of Indian forestry, published in 1926, says: "Perhaps one of the most remarkable developments in the preparation of a well-considered scheme of forest exploitation in India has been made in the Madras Presidency, initiated by Messrs. S. Cox, C.I.E., late Chief Conservator, and C. S. Martin, Chief Forest Engineer".

Much as has been achieved, we have only made a beginning as is shown throughout the other chapters of this report. Ample opportunity exists for broader expansion and even greater service to the Presidency.

CHAPTER III.—PROPOSED EXPANSION IN THE UTILIZATION OF MADRAS FOREST RESOURCES.

A. Why expansion is needed.

Expansion needed to fill enormous local demand now supplied by imports.

123. As has been pointed out in Chapter II, sections B and E, an enormous demand exists for timber in various forms in Madras. The greater portion of this demand is being filled by importation from other countries to the value of nearly a crore of rupees annually. We have the forests from which raw material can be obtained to supply much of the demand now filled by imported timber (vide Chapter II, section A).

124. That great expansion in production from the forests is permissible without exceeding the possibilities of the forest to replace the timber growth will be shown in section B of this chapter.

To increase Government revenues and reduce taxation.

125. Owing to the smallness of the forest area being exploited as compared with the extensive area being administered, the revenue which the Government derives from the forests is very small. If the forests were made to produce a greater revenue, the amount Government would have to demand from the tax-payers to pay the cost of administering the Government would be lessened and tax rates accordingly lowered.

Plants to convert raw material required.

126. We have the natural resource; we have the consuming market. All that is necessary to keep at home money now being paid out to other countries for timber imported, to more fully utilize the potentialities of the forests, and to increase Government revenues from the forest, is the establishment of plants which will convert the raw material into the form required by the consumers. To do this saw mills, ply plants wood-using factories and logging equipment to extract timber from forests inaccessible to country methods, are required.

What has already been accomplished in this respect is shown in Chapter II, section F. What can be done in the ensuing five years, with the rate at which labour can be trained carefully considered, is presented in this chapter.

To reduce production overheads.

127. Another argument for expansion is that present production costs in forest exploitation enterprises are higher than they should be because with our limited equipment the volume of outturn is small and direction overhead are distributed over a comparatively small number of units. The present executives are capable of handling a much larger producing organization, and with increased outturn the overheads per unit would be correspondingly decreased, and the cost of production thus lowered.

To keep abreast of expansion in other tropical countries.

128. The importance of keeping abreast and, where possible, ahead of forest developments in other tropical countries is another potent reason for expansion. As has been shown in Chapter I, section B, the trend of the world's hardwood lumber industry is toward the Tropics. Those countries which have laid the foundations of efficient organization for production, which have trained the nucleus of skilled labour, and have "got in on the ground floor" in the lumber markets of the world will profit most, when, with the exhaustion of their own forest resources, the big demand for timber comes from the northern countries of the world.

B. Expansion permissible without exceeding the possibilities of the Forest.

129. The tabulation given in Chapter II, section A, shows that we have in Madras, at a very conservative estimate, 557, 553 acres or 871 square miles of what are designated as "commercial forest".

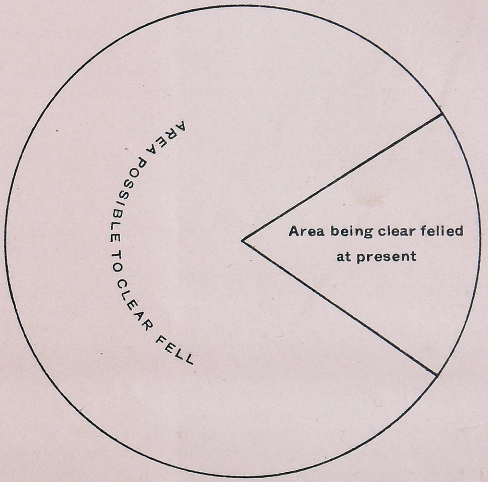
There are undoubtedly other large areas in the 19,012 square miles of Madras Reserved Forests which are adding volume increment at a rate which will bring them into the commercial forest class well within the present rotation. In addition, there are other forest areas which, while not classed as commercial forest,

COMPARISON BETWEEN

AREA OF COMMERCIAL FORESTS NOW BEING CLEAR FELLED ANNUALLY

AND

AREA WHICH CAN BE EXPLOITED WITHOUT EXCEEDING POSSIBILITIES OF FOREST.



Area of commercial forest which can be exploited annually by clear felling. ....5,350 Acres.

Area being clear felled annually (Average of 1924-25 and 1925-26) ....1,230 ,,

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1926.

are capable of producing timber as is proved by the fact that at the present time they are producing 1,473,700 cubic feet or 61 per cent of the total annual outturn from Madras Government forests. However, for the sake of conservatism, we will consider in this discussion only 871 square miles of commercial forest. Of this area, 97,566 acres are found in Coimbatore, Ganjam and Godavari districts, and 459,987 acres in South Kanara, Malabar and Tinnevelly districts. Assuming a rotation of 130 years in Coimbatore, Ganjam and Godavari, we could clear fell 750 acres each year for ever without reducing our forest capital. For the rain forests of Kanara, Malabar and Tinnevelly a 100-year rotation should be ample. We can therefore clear fell each year 4,600 acres in perpetuity. Working on a sustained yields basis we may thus cut each year 5,350 acres or 8.4 square miles of the 1,871 square miles of commercial forest. At the present time we are only clear felling 1,230 acres. We may therefore increase our annual cut 435 per cent without exceeding the possibilities of the forest!

Annual cut may be increased 435 per cent.

130. The average of the stand per acre on the areas of commercial forest clear felled during the last two years was 392 cubic feet. On this basis we may anticipate an annual outturn from 5,330 acres of 2,097,200 cubic feet. Actually we have from accurate enumerations that many of the forest areas contain a much heavier stand. Also, standards of utilization are continually increasing and in the future much more of the forest stand will be saleable and the outturn per acre consequently much greater. Whereas now only a comparatively few species of the hundreds growing in the forest are sold, with the establishment of new species on the market, the addition of machines to utilize wood waste, and the saving of loss from deterioration by proper seasoning and preservative treatment, the amount of timber utilized from each acre of forest will be greatly increased.

Standards of utilization increasing.

131. It is of course necessary to regenerate the areas cut over each year. However, if the trees could survive the struggle for existence and grow to maturity on the land now covered by forest, it is not unreasonable to expect that they can be grown again when aided by the science and skill of what His Royal Highness the Prince of Wales characterised in his opening address before the British Empire Forestry Association on 16th March 1926 as "an admirable forest service"—the Indian Forest Service. A new forest at least as good as the present one can be obtained. It *should be* possible to greatly improve the forest by raising a new crop of only the best species, eliminating the less valuable kinds found in the very mixed virgin forest.

Regeneration.

132. Objection is occasionally raised to forest exploitation because of fears on the part of the agriculturist on the plains below that water run off will be influenced. When it is considered that even when the maximum potentialities of the forest reached, less than 1 per cent of the commercial forest area (actually 0.96 per cent) and only 1/23 of 1 per cent (0.044 per cent) of the total reserved forest area will be cut over annually, their fears are groundless. The area cut over each year will be immediately regenerated. An inspection of any logged over area on the West Coast after the first following monsoon will disclose a solid mass of vegetation the height of a man. An inspection of the areas worked over in Chenat Nair Forest on the so-called clear-felling system will disclose a heavier stand left on the ground than is found in many natural deciduous forests, since there are always many unsound and crooked or mal-formed mature trees left standing which are uneconomical to extract. These, and the large number of trees under $3\frac{1}{2}$ feet girth which are also left, effectively carry on the water storage function of the forest. No exploitation expansion proposed will in any way affect rainfall or water-supply.

Proposed exploitation expansion will not affect water-supply.

133. In connection with the discussion of the potentialities of the forest the following excerpt from an address delivered by the Chief Conservator of Forests on the occasion of the Madras Forest College Prize-giving, 1925, is of interest:—

"I am a confirmed optimist, but when one considers the possibilities of development which exist in the Madras forests it is impossible not to be optimistic. I have little knowledge of provinces other than Madras, but forest development is in its infancy

everywhere in India, and I imagine that the conditions in the provinces from which so many of you come, are very similar to those which exist here. We have in this Presidency, apart from sandalwood and red sanders forest, at least 2,000 square miles or $1\frac{1}{2}$ lakhs of acres of real timber forests which contain vast quantities of valuable trees. From this huge area we extracted during 1923-24 just about $12\frac{1}{2}$ lakhs of cubic feet of timber or 1 cubic foot per acre. Now in some European forests the mean annual increment, i.e., the quantity of timber which grows every year on an acre is as much as 90 cubic feet. Conditions here are much more favourable for rapid growth and we can safely assume that on every one of these $12\frac{1}{2}$ lakhs of acres 25 cubic feet of timber grow every year. It is obvious that if you have 25 cubic feet growing and only remove 1 cubic foot you are wasting 24 cubic feet. These 24 cubic feet merely fall down and are eaten by white ants and a simple calculation will show you that the waste every year on $12\frac{1}{2}$ lakhs of acres is 600,000 tons. Now, this waste would not be a matter of consequence if there were no possibility of putting the timber to profitable use, but, while the white ants are eating 600,000 tons of timber every year, India imports timber valued at some crores of rupees. The timber which rots in our own forests is as valuable as that which is imported and which costs India so much, and much of it is more valuable.

"Now what would be the result if we had the organization to put the annual yield of the forests to a profitable use? I said just now that instead of extracting 25 cubic feet from every acre of the $12\frac{1}{2}$ lakhs of acres of timber forests we only extract 1 cubic foot. On this we get a profit of something in the neighbourhood of 8 annas, but the total amount realised is so small compared with the establishment which we have to maintain to manage and protect the forests that the profit is entirely eaten up and our $12\frac{1}{2}$ lakhs of acres of timber forest bring into the coffers of the State practically nothing at all. You have been privileged to see the logging operations at Chenat Nair so admirably conducted and organized by Major Chipp under the able guidance of our Chief Forest Engineer. These operations are entirely new to India. It is only a matter of extending their scope to make all the timber which now goes to waste available to the consumer. If we do this and can make use of the 25 cubic feet which grow on every acre, while we could not expect a profit of 8 annas per cubic foot, as much of the timber would be low grade stuff it is perfectly reasonable to look for a profit of 2 annas after paying for establishment. This would mean Rs. 3 per acre, or on $12\frac{1}{2}$ lakhs of acres nearly 40 lakhs, where now we get nothing at all. You may think I am over sanguine, but when I tell you there are several forests in Europe which yield a net income to their owners of Rs. 13 per acre, I think you will agree that I have cause for being optimistic, and that there is something in what I have said about the bright future before the Madras Forest Department."

C. Markets Available.

134. In Chapter II (present situation in Madras) a description has been given of the present potential timber markets of the Presidency (Home markets) and this report will endeavour to point out how these home demands may be met from the Presidency's own forests. In addition to these home markets one must always consider the possibilities of outside and overseas markets which may be able to absorb many of our timbers for purposes for which they are more suited than those to which they would be put locally and from which transactions higher net remuneration may be expected.

Introduction.

135. The question of marketing the timber obtained from the Government forests has always proved a great problem to the Forest Departmental officer. Every District Forest Officer has been entrusted with the disposal of the timber from his district and such disposals have invariably taken the form of auction sales of the timber in log form. Such procedure has led to the formation of buying rings which cannot be broken except by seeking outside markets with more competition. Moreover, such periodic local sales have allowed the local demand to be gauged, and fellings in the forests have been very largely regulated by the extent of this demand rather than by the economic exploitation possible and advisable. This limitation of local demand and supply is well illustrated on referring to Chapter II where it will be seen how little the forest resources of the Presidency have been utilized to meet demands within the Presidency. Hence wider distribution of Government timber supplies is highly desirable, but the difficulties to be encountered are many.

136. In the first instance, one must consider the problem of dealing with very many species of timbers, and the impossibility of guaranteeing a continuous supply of any one species. Marketing, of course, depends on utilization and therefore the only solution which presents itself is that of *classifying our many timbers into utility classes.* Such classification must be based on scientific test and practical experience—the work of the Research Branch.

Problems to be considered.

The following classification is suggested:—

(i) *Constructional timbers* of which in due course the greater proportion should be placed on the market in converted form—scantlings, timber, planks, decorative interior trim, etc.

Utility classification of timber.

(ii) *Ornamental timbers* in the form of logs and flitches or converted in the form of dimension stock and the manufactured articles, such as veneers, panels, decorative interior trim, etc.

(iii) *General utility timbers* generally converted on the spot into products of utilization industries, such as boxes, tile frames, flooring, doors and windows, silo and barrel staves, ply wood, cheap planking, etc.

(iv) *Sleeper timbers* supplied in the form of converted sleepers and obtained mainly from timber of the same species but not of good enough quality for purposes under (i) and (ii) above.

137. Secondly, there has always been the difficulty of meeting the existing demands of the market, i.e., of supplying material in the form required, such as in scantlings, boards, planks, etc. This difficulty can only be met successfully by installing saw mills, dry kilns, and re-maunfacturing plants.

138. Thirdly, to develop markets, there must be a sound and authorised system of grading. Mr. A. W. Betts, Consulting Engineer, Tropical Timber Properties, New York, may well be quoted:

Grading.

"With both the European and American markets, there is one outstanding requirement which cannot be stressed too heavily and which should not be difficult to realise, once its importance is appreciated. This is accurate, honest grading according to established rules, and the honest shipment of lumber as specified. Failure to appreciate this has done more to retard the introduction of tropical hard woods in the market than any one or dozen other things." This question is dealt with more fully in Chapter III (G) 1—"Grading Bureau."

139. Fourthly, there is the difficult problem of nomenclature of our timbers, for it is essential for a purchaser to know what timber he is buying. The Forest Research Institute, Dehra Dun, has helped us greatly in this respect by issuing a fixed set of trade names of the majority of our possible commercial timbers which can only be popularised in due course by constant use and propaganda.

Nomenclature.

140. Fifthly, there is the problem of distributing supplies of timber, of keeping in touch with and investigating other than local markets, and of co-ordinating price lists. This work is now entrusted to the newly formed Forest Utilization division.

Distribution.

141. The possibilities of introducing and effecting the above proposals are absolutely inter-related with the other work of the Engineering Branch. The cruising of forest areas to be exploited enables forecasts to be made of future available supplies for sale, the introduction and maintenance of saw mills make possible the putting on the outside market of a product which can be sold on specification and which will meet the requirements of the customer.

Only by such means can the full exploitation of our forests be made economically possible and markets developed to absorb the increased quantities of timber thus made available.

Present situation in home markets.

142. The markets to be considered may be classified as follows:—

(a) Home or Indian markets.
(b) Overseas markets.

(a) *Home markets.*

(i) Present situation.

143. As has already been stated, the portion of the Home markets met by the Madras Forest department up till recent years has been represented solely by local auction sales of timber in log form.

In this way local businesses have been built up and therefore a certain local demand for logs is always present around the timber depots.

This system of log sales in depots must always be kept in view as the main market for disposing of timber extracted from the Government forests, and it is the most desirable as it maintains and fosters local industries and trade, and ensures a keen local interest in the work of the Forest Department.

144. But a glance at Chapter II will illustrate how private enterprise has failed in distributing those timber supplies obtainable from the Presidency forests. The fact that nearly Rs. 1,00,00,000 worth of wood is imported on an average every year into the Presidency is almost unbelievable, and is the strongest argument for showing the vast possibilities for enlarging the present markets for our own timbers. The whole recommendations of this report are for the Forest Department to be put in a position to meet some of those demands by increasing exploitation, and so demonstrate that our own forests can produce suitable timber for the needs of the consumer. The recent introduction of engineering machinery and saw mills are part of the general scheme of progress.

145. Thus, the introduction of saw mills by the Department has been advocated primarily as a means of taking surplus supplies of timber which will not be absorbed by local business, off a local market; of converting it into a commercial product and enabling it to be put on an outside market, thus permitting more intensive exploitation of the forests, and also giving wider publicity to our timbers and encouraging a larger demand.

146. These outside markets are at present being met by supplies of material obtained outside the Madras Presidency. For example, in the Railway supply of sleepers for 1926-27, amounting to 1,900,225 cubic feet, this Presidency found only 20 per cent of the total of which the Forest Department supplied 7 per cent of the Madras total or 1.4 per cent of the total quantity required.

147. A better showing can be reported as regards supplies of sawn material, for the mills at Beypore and Pollachi are now fully engaged in sawing material for the Madras and Southern Mahratta Railway orders. The fact that these two mills have orders for three months ahead so soon after commencing operations is proof enough of the want of such manufacturing plants. The Mill at Olavakkot has secured the order for the sawing of material for the Mettur project thus showing that with high standards of grading and the ability to supply sawn material to order, the scope of Madras timbers is already enlarging. Orders are already being received for sawn material for Public Works Department constructional programmes and as regards the box industry which has been started at Olavakkot, the supplies of timbers, which were originally in large quantities and which were considered valueless, have run short owing to the large number of orders received.

148. If the Forest Department can lead the way and show that the Presidency possesses timbers which can meet the greater portion of its immediate needs, it will encourage private capitalists to invest money in timber operations and thus build up an industry which is particularly suited to the inhabitants and conditions of South India.

(ii) Future development.

Future development to supplant imports.

149. For the Home markets efforts must be directed to meet and develop those markets which are present but which are being met by supplies from outside the Presidency.

150. A striking item in the statement of average annual timber and manufactured wooden article imports, amounting to Rs. 98,71,068, is that over 80 per cent (Rs. 79,50,737) is for teak from Burma. This monopoly has been obtained

on the reputation of Burma teak for soundness and grading of quality, availability of supplies, superiority as regards strength and working qualities, and the supply in the form of squares which makes for better and more economic conversion.

151. The Forest Research Institute, Dehra Dun, has now issued statistics and reports to the effect that Madras teak is as strong, if not stronger, than that from Burma, and therefore it can be used to advantage in buildings and construction. Moreover, recent reports tend to show that supplies in Burma are becoming more and more limited, and prices are increasing. This is confirmed by enquiries from the Bombay markets for forward contracts of Malabar teak owing to shortage of supplies from Burma.

152. Madras can easily compete with Burma in the Madras market as regards price, and this fact should overcome local prejudice as regards working qualities. The Public Works Department has already issued orders favouring the use of local teak and it only remains for the Forest Department and timber merchants to make supplies available in sufficient quantities and in the form of squares or sawn material.

153. But, at the present, it is impossible to expand operations sufficiently to meet *all* the demands for teak, and the solution seems to be in encouraging the uses of other timbers which are much cheaper and just as suitable for the required purposes, provided they are properly seasoned and utilized. In the initial stages of developing markets for our timbers only those should be chosen which are economically preferable and which will lead to rapid expansion.

Sleepers.

154. As regards the demands of the railways, every effort must be made to increase the department's sleeper supply. The danger of relying on outside sources for such an important item of vital internal organization is very grave. Australia, Canada, and the United States cannot be relied on to give an indefinite supply, especially when their own Governments are issuing warnings about a timber famine within a comparatively few years. The Railway Board at Simla have realized the importance of obtaining internal supplies and are now making a survey of forest resources in this connexion. Madras must take her share and large quantities of very many suitable woods are to be found in her forests. Many of the species are accepted by the railways, the most suitable of which is teak. However, teak is now in such demand for other uses that ordinary teak sleepers cannot be supplied except at rates which are prohibitive to the railways. Hence, research must be continued to test out other timbers, especially with a view to making large supplies to some central preservative treating plant.

155. Steel sleepers of Indian manufacture are now beginning to be used to an ever-increasing extent on our South Indian lines. All new construction work on the South Indian Railway is employing these steel sleepers, but steel is a commodity which may fluctuate in price and the railways may find themselves faced with a very expensive sleeper programme. Hence it is up to all parties to encourage the wooden sleepers supply and to help to make this Presidency more self-supporting than at the present time. The Southern Group Sleeper Pool have agreed to accept from the Forest Department at pre-arranged prices any quantity of sleepers of accepted species which the latter can supply.

156. As regards building and construction works, the Forest Department must continue to endeavour to supply sawn material on indent. If private contractors and companies know that they can indent for, and expect to receive up to time, sawn material cut to order, the department's saw mills will certainly be kept fully employed, and so encourage private enterprise to enter the milling business.

Railway construction.

157. The demands of locomotive and carriage works show that this is a field which calls for the special attention of the lumber industry and especially the Forest Department. Teak is used for the majority of work in this connexion simply because of its well-known qualities. Many other woods at much cheaper rates could be employed for 50 to 60 per cent of the work where teak is now employed, but are reported

unsuitable owing to warping, cracking and bad working. Proper kiln-seasoning seems to be the secret of this problem and the fact that the Forest Department is leading the way in installing dry kilns in South India is only one way, but a very important one, in which the department is seeking to utilize and popularize the timbers of the Presidency. Much can be done in this field as the railways are very interested in really well-seasoned material.

Public Works Department.

158. The Public Works Department demands can be met by encouraging contractors to use Madras timbers. This can only be effected by arranging distributing centres of sawn material all over the Presidency at which the material required can be obtained. But the main effort must be directed to encourage the wider use of timber in buildings, such as wooden block and board floors, decorative panelling, etc., which will give greater comfort and better appearance than in the past.

Planting Industry.

159. In the planting industry, sawn material must be made available for buildings, but chiefly it is on the box industry that attention must be focussed. The fact that in 1925-26 the value of tea chests imported from overseas amounts to almost Rs. 12,00,000 is very striking. To meet this demand, the installation of veneer and three-ply plants has been advocated in this report, and not only for boxes will such ply-wood be available. Three and five-ply wood is most suitable for partition work, motor bodies, carriage and interior panelling, auditorium and railway carriage seats, and furniture. With an initial market for tea chests which will immediately absorb the whole output from a ply plant, the further markets which could be developed in the meantime, makes the proposition a very favourable one.

Miscellaneous markets.

160. Under miscellaneous demands which can be met in the future, the harbour construction works can be encouraged to purchase sleepers from Madras sources, also piling and wood paving blocks for warehouses, docks, piers, etc.

The box industry can easily be exploited and increased, but very much work has yet to be done in grading and classifying our many box woods for the several requirements, such as colour, weight, and supplies available.

Mouldings is another item which can be met from our own woods providing machinery is available. It should form a very profitable and useful subsidiary industry to a central saw mill.

Other subsidiary industries which can profitably be worked up are those for supplying railway keys, tool handles, tile frames, electric wire casing, spokes and felloes, flooring blocks and flooring.

Summary.

161. Thus to sum up, for Home markets, efforts must be directed to meet and develop demands for—

(a) logs of all species,

(b) converted material in the form of—

(i) construction timbers for the use particularly of Public Works Department, railways and other public bodies;

(ii) products of utilization industries in the form of boxes, tile frames, cheap planking, flooring, railway keys. These small and profitable utilization industries must be built up around a central saw mill and exploitation centres to enable species and small material to be used which otherwise may be considered as *waste*;

(iii) sleepers for the Railways and large Public Works Department schemes.

(b) *Overseas markets.*

162. In considering overseas markets, one must take into account the conditions ruling in those places, as to their requirements in view of local supplies or supplies obtained from more economic centres. In the case of South India, the overseas markets may be considered under two headings :

(i) African and Arabian markets.

(ii) European and American markets.

163. Up to the present time, Madras has never been able to consider supplying the African and Arabian markets. There can be no doubt that large quantities of imported timber material is in demand owing to lack of local supplies, and this is fully substantiated by an extract from "Forest Resources of the World", by Zon and Sparhawk, which gives the following figures for annual timber imports :—

African and Arabian markets.

	CUBIC FEET.
Union of South Africa	19,500,000
British East Africa	160,000
Egypt and Sudan	21,412,000
Mesopotamia	14,246,000

(NOTE.—The figure for Mesopotamia is for consumption of timber. Local supplies small as country is almost destitute of timber now.)

Of British East Africa, Professor Zon says: "Imports are rapidly increasing, consisting chiefly of coniferous woods from Scandinavia and the West Coast of America."

164. The increasing imports are due no doubt to the recent developments in the opening up of the cotton and groundnut industries, and the many projected railways. The necessity of big building programmes in connexion with the making of suitable export centres on the Coast ensure the certain demand for railway sleepers, constructional timbers and interior trim.

165. South Africa has no local supplies of hardwood timber and with its growing population and post-war development, it will demand large supplies of constructional and ornamental timbers. Of South Africa, Professor Zon states: "The imports, on the other hand, consists chiefly of pine, hickory, oak, walnut, yellow poplar, and a large amount of flooring and ceiling."

166. Again, of Egypt and the Sudan, he states: "The imports were furnished by Sweden, Russia, Rumania, Austria-Hungary and the United States." That India is expected to be able to compete in this market may be gathered from the numerous enquiries which the Utilization Branch is receiving, especially from Port Sudan and Khartoum for building material and sleepers. The opening up of Port Sudan as a cotton-exporting centre is bound to make it an important port and one economically situated to be fed by timber supplies from India. Mesopotamia is another country from which demands for timber must increase owing to lack of supplies.

167. For these big potential markets, India at present supplies only about 100,000 cubic feet mainly of teak, while Australia, the United States and Europe furnish the balance. In India are to be found many woods as good as hickory, walnut and oak, and they can be delivered to many of the countries named at good competitive rates. Madras cannot hope to meet all these demands, but she can at least develop a market for all she can produce and can co-operate with other parts of India to build up an Indian hardwood timber trade.

168. The Governments of India and Madras have already realized the possibilities in these markets and as a result have deputed Mr. C. S. Martin (Chief Forest Engineer, Madras) for a tour of investigation into these centres of demand.

169. In this connexion it is well worth pointing out that in 1923 and 1924, the Queensland Government of Australia applied to the Government of India for quotations and availability of supplies of Indian hardwoods for ornamental and constructional purposes in Australia. The reference was passed on to Madras, but this Presidency was unable to offer any supply owing to lack of business organization, inability to give sawn material, and absence of grading rules. Australia then turned her attention to the Philippines and the 1925 trade returns of the Philippine Government show that Australia is second only to America in quantity and value of timber purchases from those Islands, owing mainly to the Phillipines' ability to put on the market a graded product in the form required by the consumer.

170. Phillippine hardwoods have now dominated the hardwood market of the Pacific Coast of America and are assuming an ever-increasing importance in the English, European, Eastern United States, Australian and Japanese markets.

171. *Future development.*—The conditions existing in the Arabian and African markets seem to indicate that the lines for development must be to meet the demands for—

(i) Construction timber in the form of scantlings, boards, timbers, etc. Tropical hardwood species seem especially suitable for building construction in these countries and a very considerable market at good prices should be available.

(ii) Ornamental timber in finished form, such as interior trim and panels, but only a very small market can be expected in this direction for many years, as the manufacture of such material requires highly trained labour and expensive plant.

(iii) Products of utilization industries, such as flooring, windows and doors, etc.

172. As regards sleepers, it is considered that demands are so large in South India that efforts should not be made at present to develop an export trade.

(a) *Past history.*

European and American markets.

173. Up to the present time, all the distribution of timber from the Government forests in South India to the European and American markets has been effected through a sales agency.

In 1917, the Government of India entered into conversations with Messrs. Howard Brothers of London for this firm to act as sole agents for the sale and distribution of Indian timbers despatched to them by the Government of India and local Governments, and an agreement was reached in 1919.

174. The London Timber Exhibition of 1920 gave the first impetus to our export trade and logs of many of our species were sent to England in 1919. However, only single logs were sent and these were declared by the agents as being too small in quantity to test out the market possibilities, although Terminalia tomentosa (laurelwood) was first marked as having great promise.

Sample consignments continued to be sent in 1920 and 1921, mainly of laurel wood, and our trade may be said to have commenced in this latter year.

Laurel wood and rosewood continued to be the main species in demand, and continued to grow in popularity.

175. The next landmark in our overseas trade history was the British Empire Exhibition of 1924, and fairly large sample consignments were sent to London in 1923.

The timber sent for exhibition and experimental purposes were Adina Cordifolia (Haldu), Terminalia paniculata (Kindal), Pterocarpus marsupium (Vengai), Calophyllum tomentosum (Poon), Hardwickia pinnata (Malabar mahogany) and one or two junglewood species, in addition of course to Tectona grandis (teak), Dalbergia latifolia (rosewood) and Terminalia tomentosa (laurelwood).

176. All of the above were reported on favourably, especially the laurel wood. A few extracts from periodicals and reports are interesting in this connexion. The *Timberman* of America writes of this species: "Although admittedly one of the finest woods the world possesses, laurel wood has not yet been received with the enthusiastic acclaim it merits. The magnificent displays at the Empire Exhibition are, however, undoubtedly having an effect on its popularity." And again: "All the wood work in the Forestry Court of the Indian pavilion is of a very high order, with the first place going to the laurel wood billiard room, in which all the fittings, the panelling and the billiard table have been entirely made in this wood. Throughout the Court, in fact, this wood can be seen to advantage in many articles, including book-cases, chiffoniers, bureaus, tables, music cabinets and especially in some beautiful screens." Its steadily increasing popularity may be gathered from the fact that this wood has been specified and used in panelling and fittings

in the main hall in the new London County Council Hall at Westminster, in the Westminster Bank in the City of London, in certain of the new buildings which are being erected in Regent Street, London, in the International Labour Office in Geneva, and also for the decorative wood work of three of the latest Cunard Liners. Many other instances could be cited, but the above will be sufficient to illustrate that this timber is now established on the market.

177. With the exception of rosewood which is even more firmly established than laurel wood, the other species mentioned above do not command sufficient interest to make them of especial value to command outstanding prices. They therefore have to compete with other ornamental hardwoods, such as the oaks and mahoganies which are available in converted form at reasonable prices and in large quantities on the European market. This competition is unfavourable to us at the present time owing to high freight rates and the fact of having to ship in log form.

(*b*) *Trade returns.*

178. The following is a statement showing the returns obtained from our European trade. The results of the timber transactions up to 31st July 1926 carried out on the London market through the Government agents, Messrs. W. W. Howard Bros. & Co. of London, are tabulated in the annexed table. Briefly enumerated, they show that 31,987 cubic feet have been consigned to the agents for sale, of which 24,527 cubic feet have been disposed of at an average net rate of Rs. 5-3-6 per cubic foot. This rate must appear very small when compared to the gross rates which the timber has been fetching on the market—rosewood, £25 to £30 per ton of approximately 35 cubic feet, or Rs. 10 per cubic foot and laurel wood (Terminalia tomentosa) 18*s*. per cubic foot sawn as 1-inch planks or Rs. 11-8-0 per cubic foot (sawn material). These differences in prices are accounted for by charges incurred in England for unloading, storage, dock and shipping dues, handling, sawing and commission. They illustrate only too well the advisability of adopting some such policy of carrying on our overseas trade as is recommended in other parts of this report, that is, of being able to sell direct from India through agents in India who have representatives all over the world, or, in the case of limited log sales, of selling direct by brokers, thus eliminating high storage and sawing charges in England.

179. If overseas trade is to be developed in selling our high-grade ornamental timbers direct from India through distributing agents, facilities must be made available in the form of saw mills and remanufacturing plants in India, to place on the market timber in the form of boards, flitches, interior trim, panelling, veneers and small dimension stock.

Profits from London sales.

180. The London market business, although not giving to Madras the large profit one might expect, has resulted in a net profit of Rs. 51,000 and a net surplus of approximately Rs. 17,000 over proceeds which might possibly have been obtained if the timber had been sold in India.

Moreover, it must also be taken into consideration that the sending of supplies to an overseas market has taken that quantity of timber of the local market with the probable result of obtaining higher prices in the local market for the timber left.

181. Although the agency of Messrs. W. W. Howard Brothers with the Government of Madras is due to terminate on 31st December 1926, it must with all due fairness be stated that this firm has done a tremendous amount of invaluable work in placing Indian timbers on the world hardwood market and, through their agency, Madras has obtained a firm footing in those markets with at least two of its timbers—not with loss or expenditure as is usual in most cases, but with a net surplus profit of Rs. 17,000.

182. Results of timber export to London—

	CUBIC FEET.
Total quantity of timber sent to the London market up to 31st July 1926	31,987
Quantity of above timber sold by agents to 31st July 1926	24,527

	RS.	A.	P.
Net proceeds credited to Madras for 24,527 cubic feet.	1,27,973	0	0
Rate per cubic foot for 24,527 cubic feet	5	3	6
Average cost per cubic foot, including extraction, handling in India, freight and insurance to the London market	3	2	2
Profit per cubic foot	2	1	4

The above 24,527 cubic feet of timber sold was made up of approximately—

	CUBIC FEET.	
Laurel wood (Terminalia tomentosa)	11,660	
Rosewood (Dalbergia latifolia)	10 180	
Teak (Tectona grandis)...	2,170	
Other species	517	
		24,527 cubic feet.

If sold in India at local depots, the gross proceeds would have been—

		RS.
11,660	cubic feet of laurel wood at Rs. 1-4-0 per cubic foot ...	14,575
10,180	,, of rosewood at Rs. 3-8-0 per cubic foot	35,630
2,170	,, of teak at Rs. 3-8-0 per cubic foot	7,595
517	,, of miscellaneous species at Rs. 1-8-0 per cubic foot	775
		58,575

	RS.	A.	P.
Average rate per cubic foot (gross)	2	6	2
Average cost per cubic foot extraction and overheads	1	0	0
Profit per cubic foot	1	6	2

	RS.	A.	P.
Rate per cubic foot in favour of selling in London market Rs. 2—1—4 *minus* Rs. 1—6—2	0	11	2
Net financial gain from London market transactions to 31st July 1926—24,527 × As. 11—2	17,118	0	0
	(approximately)		

183. As regards trade with America, this Presidency has not previously sought to open direct trade relations with that country although it is one of the biggest potential customers for ornamental hardwoods. Supplies have, however, reached America through London and instances have been recorded of the use of laurel wood and rosewood in the big furniture manufacturing centres and mills of Grand Rapids, Louisville and New York.

Future possibilities in export markets.

184. The future possibilities of obtaining a market in America are already partly described in the introduction to this report. These are confirmed, together with similar opportunities in Europe, in a note attached to this report: "The Veneer industry and its relation to the profitable utilization of South Indian hardwoods"—Appendix.

185. Limited export of laurel wood and rosewood in log form may still be continued, but it is considered that the introduction of our many unknown beautiful timbers can only be developed as recommended in that note, i.e., in the form of veneers or flitches, and moreover by this means increased utilization and distribution of rosewood and laurel wood are made possible. This is well illustrated in the case of the Philippine Islands mahogany trade which has shown a remarkable increase in production and distribution through adoption of such methods of utilization and sale.

186. Especially with the American market is the development of trade in South Indian hardwoods by putting them on the market in the form of panels, veneers, or flitches recommended, as, if operations are to be confirmed to log sales only, it will be necessary to open up American agencies, consign large supplies of logs for sale, which means tying up capital, and overcoming prejudice against timbers of unknown qualities.

187. The present system of granting a sole agency to one firm has been condemned by the Government of India, and, in December 1926, the agency of Messrs. W. W. Howard Brothers, London, terminates. However, it is desirable and even necessary to have agents to handle and dispose of our timbers, either in the form of log or converted material, and negotiations are on foot to obtain agents in South India who have representatives in all parts of the world. This will enable the department to keep in touch with widely distributed markets, and will provide a commercial trade and distributing organization. Trade relations can be effected through such agents with timber consigned direct from India in the case of converted material, but, in the case of logs, such as laurel wood and rosewood for the European markets, it may be necessary for sales to be handled ultimately through brokers at the receiving port.

188. But our chief concern must be in trying to place on the market many of our other ornamental timbers and this question of developing markets is fully discussed in Appendix A of "The Veneer industry and its relation to the economic development of South Indian hardwoods."

In accordance with the view set forth therein, the European and American markets can only be expected to take *ornamental timbers* which are in demand and for which specialized prices may be expected.

Conclusions.

189. In summing up the contents of this section "C", it cannot be denied that opportunities do exist for developing a very extensive market for the timbers of the Presidency, but that to ensure any degree of success the following points must be given due consideration:—

(a) A fully trained utilization staff must be made available to enable it to fulfil the important duties entrusted to it. The branch is bound to increase in importance and numbers and every facility must be given to allow it to expand to take advantage of economic opportunities. Facilities must be given for grants of study-leave and even for special courses of instruction in foreign countries.

(b) Saw mills and utilization plants are essential to meet the demands of markets and to allow markets to absorb the full economic outturn of the forests.

(c) A system of grading and inspection must be authorized and enforced and Government must be prepared to take the lead in this essential.

(d) Considerable propaganda must be carried out to encourage uses of timber to try out local species to replace imported species and also to standardize names of timbers.

D. Areas from which outturn to Supply Market can be obtained.

190. All of the areas of commercial forest given in Section A, Chapter II, can be exploited. During the ensuing five years, however, we propose to take up work only in the following areas:—

(1) *Wynad Forests.*—Evergreen, 25,488 acres; deciduous, 51,688 acres; total, 77,176 acres, commercial forest already being exploited in Chedleth and Begur ranges to supply Mysore and Nanjangode Depots and portable saw mill established at Chedleth, 1926-27.

(2) *Nilambur Forests.*—Plantation Working Circle, 1,479 acres; Conversion Working Circle, 7,293 acres; and Nellikutta Reserve, 1,539 acres already being exploited to supply Beypore Depot. New Amarampalam Reserve, 52,200 acres, as yet untouched, accessible for exploitation. Shoranur-Nilambur Railway to be completed in 1926-27 makes extension of working to New Amarampalam particularly attractive.

(3) *Palghat Division Forests.*—Chenat Nair Reserve being exploited to supply Olavakkot saw mill. Work will continue in 5,297 acres yet unexploited. Chenat Nair has been completely mapped and cruised showing an average of 360 cubic

feet per acre in Elival Valley and 400 cubic feet per acre in Kalladikode. Sappal Valley, now being worked, averages 700 cubic feet per acre. Eventually, operations will extend to Attapadi, 25,190 acres, and Silent Valley, 11,060 acres.

(4) *Mount Stuart Forests, South Coimbatore.*—Mount Stuart Reserve, 15,000 acres, now being exploited to Pollachi Depot and saw mill; Ulandi Forest, 4,940 acres; Karian Shola, 3,652 acres. While 1,712 acres mapped in Karian Shola shows only an average of 260 cubic feet per acre, it is considered admirably suited for mechanical exploitation.

(5) *Valparai (Kal Ar Valley) Forest, Anamalais.*—Twenty-three thousand acres being clear felled, burned and planted with cinchona by Cinchona department at the rate of 250 acres a year. Cruise of 1,017 acres shows an average of 476 cubic feet per acre. The probability of a ropeway to the plains being installed by the Anamalais planters makes transportation guaranteed and probably cheaper. Any exploitation here is in the nature of salvage, timber which would otherwise be burned being utilized. Sleeper sawing operations being carried on in 1926-27. An exceptional opportunity for the establishment of a saw mill.

(6) *Papanasam Reserved Forest—5,966 acres.*—Enumeration said to show very heavy stand of timber. A pulp and paper mill to utilize the 18,000 acres of Eta reed in this reserve, together with hydro-electric development and a branch railway is expected to be established by 1929-30. With cheap power, rail transit and ample raw material, this is the finest opportunity for a forest industries centre, including veneer and ply plant, saw mill, etc., known in all India. Also 20,000 acres of timber available in the forests adjoining Papanasam on the north and 19,000 acres in Kallakad forest to the south, with a large private forest (zamindari of Singampatti) also adjoining Papanasam.

(7) *North Mangalore Forests—126,615 acres.*—Only work on a small scale in plains forest so far attempted. Someshwar Reserve 11,400 acres mapped and cruised shows average stand of 500 cubic feet per acre.

(8) *South Mangalore Forests—107,172 acres.*—Parappa portable saw mill established 1926-27. Extensive areas of over mature timber makes increased exploitation desirable.

Working Plans.

191. The following information regarding Working Plans is supplied by the Conservator of Forests, Working Plans Circle, in his Camp No. 5/26, dated 30th August 1926, to the Chief Conservator of Forests, Madras:—

"Referring to the classified list of forest divisions, it seems to me probable, but not certain, that the following are the 'timber forests' according to your definition:—

(i) Parts of the Ganjam forests.
(ii) Parts of the Tinnevelly forests.
(iii) Parts of the South Coimbatore forests.
(iv) Parts of the Wynad forests.
(v) Most of the Nilambur forests.
(vi) Parts of the Palghat forests.
(vii) Possibly small parts of North Mangalore forests.
(viii) Possibly parts of South Mangalore forests.

"Of the forests or parts of forests mentioned above, the following are now being worked more or less according to the provisions of Sanctioned Working Plans:—

(i) Parts of Ganjam forests.
(ii) Parts of South Coimbatore forests.
(iii) Most of the Nilambur forests.

"As regards the forests or parts of forests in paragraph 4 for which working plans are actually being made, we have the following:—

(i) Parts of the Wynad forests.
(ii) Most of the Nilambur forests (revision).

"Next, as regards those for which working plans are contemplated, it may be said that working plans are contemplated for all of the forests mentioned in paragraph 4.

"For only the following areas, however, is there any prospect of working plans being prepared within a reasonably short number of years, omitting those already under preparation:—

(i) Parts of Ganjam forests (revision).
(ii) Parts of the South Coimbatore forests (revision).
(iii) Possibly small parts of North Mangalore forests.
(iv) Possibly parts of South Mangalore forests.

"The areas in this paragraph are those decided upon at the recent Conservators' Conference as being the ones next to be taken up, as opportunity offers."

E. Proposed expansion Programme for ensuing Five Years.

(1) 1927-28.

192. We do not propose to establish any new plants in the ensuing financial year. The investments in new equipment, which have been included in the Part II Budget for 1927-28, are for supplemental machines required to increase the efficiency of the present plants and increase utilization by turning saw mill waste into a saleable product.

193. (a) *Additional equipment proposed for Pollachi saw mill*—

	RS.
An automatic spoke, handle and variety machine, cost erected at Pollachi	5,500
Shafting, pulleys, belting, cutters, etc., for same	1,700
Contingencies	300
Total ...	7,500

This machine is advocated for commercial experiment in tool handle and railway key production. We have at Pollachi a number of woods proven satisfactory for tool handles, including Anogeissus latifolia, Adina cordifolia, Terminalia tomentosa, rosewood, etc. The machine proposed will turn out hammer, sledge, pick, mamuties, axe and smaller tool handles, as well as picking sticks for cotton mills, spokes for motor wheels, chair and table legs, and sporting goods (cricket stumps, golf shafts, etc.). All these articles are at present imported or made by hand, a slow expensive process producing an inferior article. The annual consumption of tool handles from 18″ to 40″ by the Madras and Southern Mahratta Railway is 21,000 and by the South Indian Railway 15,000, the prices they pay ranging from Rs. 2-8-0 to Rs. 12 per dozen. The Public Works Department, District Boards and Municipal Boards are also big consumers of handles. The requirements of cotton mills for picking sticks are enormous, and very satisfactory tests of various woods supplied by us have already been made by Madras mills. Railway keys are at present all imported from Burma. They would be turned out on the automatic machine from teak scrap from the saw mill edgings, trimmings, and other saw mill waste would go into handles, thus getting greater conversion out of the logs supplied to the mill. Judging from the enquiries the Forest Utilization Officer has, the tool handle business is a splendid prospect for increasing the utilization of Madras timbers. The establishment of a tool-handle factory at Chelama, Kurnool South, has been recently discussed and with a successful demonstration at Pollachi such as the machine proposed would permit it is probable that private enterprise may be persuaded to go in at Chelama and elsewhere in the Presidency.

194.—

	RS.
Triumph 24 inches double surface planer, matcher and moulder, cost erected at Pollachi	3,250
Shafting, pulleys, belting and cutter knives	1,040
Contingencies	210
Total ...	4,500

This machine is required to turn out planed boards, mouldings, sash and door stock, tongued and grooved boards, and other finished wood used in the construction of every pukka building.

At the present time imports of moulding into Madras cost Rs. 1,08,000 annually. The proposed machine will make any kind of moulding. Electric light wire casing, interior trim, and picture moulding are kinds for which there is an increasing demand in South India. Hardwood flooring made of narrow tongued and grooved boards is admittedly the finest flooring material extant, and would be much more widely used than at present if readily available.

The above machine will turn out the most valuable class of material used in construction, and should be a very profitable adjunct to the mill. It also should help greatly to popularize the lesser known of the 15 species of hard woods available at Pollachi by furnishing them to consumers in finished form.

195. *Sheds*—

	RS.
Manufacturing shed	750
Finished product store building	1,250
Total ...	2,000

An extension of the present mill shed to house the two machines proposed herewith will be required. In addition a store building in the depot to house the finished material pending completion of orders and their shipment is required as the product of this machine is valuable.

196. (*b*) *Additional equipment for Chenat Nair extraction and Olavakkot saw mill.*

(1) Three-drum twin Fordson skidder for Chenat Nair.

With the removal of Chenat Nair extraction operations from Sappal Valley to Elival Valley, the former having been logged over, even more severe topographical conditions are encountered. Higher elevations and steeper slopes make it impossible to get up on top of the timbered area with roads at less than prohibitive cost, and it is therefore necessary to bring much of the timber *down* to the roads which can be economically located. The present skidding method of the high lead, with one or two-drum skidders which we have so successfully used in Sappal Valley, to drag logs up to the roads where they can be loaded on carts, is only satisfactory skidding *uphill*. Skidding *downhill*, all the advantage of the high lead on the line to lift the log over obstacles is lost.

197. The simplest and one of the most satisfactory methods of skidding down steep slopes is by the slack-line skyline system. This necessitates a three-drum skidder, one-drum for the main hauling line, one for the haulback or outhaul line, and a third for the "skyline", which carries the weight of the log and may be lowered to enable the choker to be fastened on to the log and raised to free the log from obstacles, picking it up in the air bodily, and bringing it into the cart road without obstruction.

198. At the present time we have in Sappal Valley only two skidders, one an antiquated Holt tractor with a one-drum winch, purchased before the formation of the Forest Engineering Branch, and the other the very satisfactory Fordson two-drum skidder purchased in 1924.

Another skidder is required for extraction in Elival because the more scattered stand (368 cubic feet per acre as against 1,000 cubic feet in Sappal) will necessitate more frequent moves. Therefore, the present two machines cannot keep up with the requirements of the saw mill, which in Sappal they now just balance, when removed to Elival. A third reason for the purchase of an additional skidder is that much of the deciduous timber found in lower Elival can be sold in the log, and we may therefore profitably increase the logging outturn over what the mill will require, which will further reduce cost of logging. The relation between outtrun and costs is graphically shown in the figures of the last three years' working in Chenat Nair :—

Year.	Average monthly outturn.	Cost of extraction per cubic foot.
	C.FT.	RS. A. P.
1923–24	5,668	4 2 5
1924–25	9,876	1 13 4
1925–26	15,600	0 14 6

199. With a third skidder of the proper type, logging costs should be reduced to approximately 8 annas per cubic foot. The fact that we have no emergency machine in case of a breakdown or an accident is also an important matter to consider, with the mill now taking in 15,000 cubic feet of logs a month. If an accident, such as occurred in June 1926 when a tree blew over the Fordson skidder, should happen during the working season, instead of just before the monsoon shut-down when time to execute repairs was available, extraction costs would double, and we would be unable to keep the mill supplied with logs—a very serious matter for a saw mill.

200. In view of the above circumstances, the following is proposed :—

		RS.
One Twin-Fordson three-drum skidder delivered Olavakkot	...	11,464
Two Fordson Engines for same delivered Olavakkot ...	...	3,990
Transport to Elival Valley, erection and mounting on sled	...	546
Total skidder	...	16,000
Wire rope for skidder, including 1,200 feet $1\frac{1}{8}''$ skyline, 1,000 feet $\frac{7}{8}''$ main line, 2,000 feet $\frac{5}{8}''$ haulback, and necessary blocks, fall backs and rigging tackle.		7,000
Grand total	...	23,000

The above machine being twice as powerful as our single Fordson two-drum skidder now in use, and using the slack-line skyline rigging method, will extract two or three times as much as our present skidder from country inaccessible for the high lead, with the same crew, and at approximately half the cost.

(2) Additional dry kilns for Olavakkot saw mill.

201. It is found that our kilns cannot cope with anything like the outturn of the breaking down section, and further that the three chambers working at peak load can only keep the box section occupied for at the most three days per week. In addition, the staff now employed in operating the one battery could easily in addition operate a further battery of two chambers, with the exception of the boiler stockers. The cost of the technical staff mentioned above is Rs. 365, which, distributed over 2,000 feet average output per mensem is Re. 0-2-6 per cubic foot. A further battery would increase output to about 4,000 feet per mensem, saving Re. 0-1-0 per cubic foot seasoned, or in a year Rs. 1,500, and this simply on staff. By providing for truck charging, it is estimated that at least six days per mensem will be saved approximately that number of days lost through hand charging. During these days the depreciation, etc., charges have to be met; working charges will be about Rs. 510 per mensem or Rs. 17 per diem. The saving per mensem will therefore amount to Rs. 102 or Rs. 1,200 per annum. In approximately four years, therefore, the trucks will have paid for their cost. The total cost of dry kilns complete is Rs. 20,000.

(c) *Valparai Sleeper project.*

202. The Valparai Sleeper project of 1926-27 having proved to be a very profitable proposition (see paragraph 82, Section F, Chapter II), continuation and expansion in 1927-28 is proposed. For this purpose, Rs. 50,000 was included in the budget submitted to Government under '8. b. I (a) Forest Produce removed by Government Agency—Timber,' and Rs. 8,000 for capital expenditure on roads, and Rs. 4,000 for maintenance. On the basis of 1926-27 cost figures with the above investment it is possible to make a profit of Rs. 36,700.

However, as the work will be pushed farther back into the forest, costs may increase. It is anticipated that, with the sum proposed, the equivalent of 10,000 broad gauge sleepers can be extracted at a net profit of Rs. 30,000.

(d) *Chedleth and Parappa saw mills.*

No additional equipment is proposed for these plants.

(e) Beypore.

203. The potentialities of Arabian and African markets have been discussed in Section C, Chapter III. An investigation of these markets has been initiated by the Government of India and funds for the work contributed to by the Central Government, Burma and Bombay and Madras Presidency. Mr. C. S. Martin, of Madras, has been selected to undertake the trade extension and market investigation tour in all the principal timber markets of Arabia and Africa. He will take up this work in February 1927 and probably return to Madras in May. As a result of Mr. Martin's tour, it may be necessary to establish an export remanufacturing plant urgently, in order that we may take advantage of the profitable business which he is expected to find. It will be essential to start quickly if we are to get a foothold in this new field in competition with other provinces of India. The exact plant required cannot be determined until Mr. Martin has ascertained what the Arabian and African markets want. From the enquiries we have already had, it is assumed that a remanufacturing and sawn veneer plant will be required. This would be established at Beypore Forest Depot in connection with the Beypore saw mill or at Calicut for convenient shipping facilities. The scheme will have to be put up for a supplementary grant after Mr. Martin has returned and the details of exactly what is required are known. The following will give an idea of the probable cost:—

Sawn Veneer Plant—

One veneer saw.
One glue mixer.
One spreader.
One press.
Twenty clamps.
One jointer.
One taper.
Two double saws.
One two-drum sander.

	RS.
Cost f.o.b. Factory ...	22,400
Freight ...	3,200
Customs and clearing ...	8,500
Pulleys, shafting and belting ...	1,900
Total veneer machinery delivered ...	36,000
Re-manufacturing Plant—	
Band resaw ...	5,000
Matcher and moulder ...	4,500
Planer ...	3,000
Rip benches and cut-off saws ...	500
Cost delivered (including pulleys, shafting and belting) ...	13,000
70-h.p. Engine and boiler ...	18,000
Dry kilns complete ...	25,000
Buildings and erections ...	18,000
Total cost (veneer and remanufacturing plant) ...	1,10,000
Add contingencies 5 per cent ...	5,500
Grand Total, Export Plant ...	1,15,500

Recapitulation of 1927-28 proposals for equipment to obtain increased utilization in present plants—

Recapitulation, 1927–28—Capital Investment—

	RS.
Pollachi ...	14,000
Olavakkot ...	43,000
Beypore (tentative export plant) ...	1,15,500
Total ...	1,72,500

204. The proposals under each year, in the following expansion programme for 1928-29 to 1931-32, are subject to exchange with some other year, as a great deal depends on outside circumstances and developments over which we have no control. The order of expansion given is that anticipated in the light of present conditions.

2. Proposals for 1928-29.

205. With the plants established in 1926-27 brought to a high state of efficiency in 1927-28, attention in 1928-29 will be directed towards additional plants to supply the demand for sawn scantlings and sleepers. While the Pollachi, Chedleth and Parappa Mills were originally proposed with the idea of cutting principally sleepers, so many profitable special orders have been received for boards and scantlings that the mills cannot keep up with the sleeper demand as well. At the time of writing, the mills are booked up with special orders for three months ahead. This year we are supplying 23,500 broad gauge and 15,500 metre gauge sleepers of all species acceptable, untreated, and the railways have agreed to take all we can cut in addition. They would like us to supply from one to two lakhs sleepers annually. We are also supplying 15,000 special size narrow gauge sleepers for the Cauvery-Mettur project this year, as well as timber for building construction, and as the Mettur project progresses, its timber demands increase. We therefore propose the installation in 1928-29 of three more portable saw mills of the type at Chedleth and Parappa. One will be located in the Kal Ar Valley, Anamalais, the area being cleared and planted by the Cinchona department. This forest contains a heavy stand of Mesua, which is acceptable for sleepers. New tea factories which are expected to be built in the Anamalais will make a market for scantlings from the mill. Begur range in the Wynad is proposed as the location for the second mill, while the third will be placed either at Nilambur or in some of the unexploited reserves in North Mangalore division, South Kanara. Which of the latter locations will be selected will depend on several factors, among which is the proposal of a private company to put in a saw mill at Nilambur.

206. The capital cost, which will be practically the same for all three mills, is as follows :—

	RS.
One No. 4 slow feed circular saw mill with top saw rig, 3 head block carriage.	4,000
One Empire Balting Machine	2,250
Eighteen 6 inches rolls	800
One cut-off saw	560
Two saw benches	1,000
One saw gulleting and sharpening machine	560
Total machinery landed, Calicut ...	9,170
Delivery site and erections	1,500
Belting and shafting	1,500
Temporary shed	2,000
Spares for one year, including saws, grinding wheels, tools, etc....	6,000
Total Saw mill without engine ...	20,170
The engine purchased will depend upon results obtained with those used in mills established in 1926–27. If the Sentinel 45–55 B.H P. portable proves satisfactory, engine cost will be ...	8,450
If the cheaper machine proves unsatisfactory, then Marshall's 20 N.H.P. (60 B.H.P.) portable engine will be used, cost ...	13,800
Total cost with Sentinel engine ...	28,620
,, Marshall ,, ...	33,970

Saw Mill Staff.

	Per mensem. RS.
One foreman	100
One head sawyer	50
One saw filer	50
One engineer	50

	Per mensem.
	RS.
One clerk and tally checker	60
One bolter sawyer	40
Two rip bench sawyers	30
One cut-off sawyer	30
One setter and assistant sawyer	30
One dogger	20
One fireman	20
Four coolies at Rs. 20 each	80
Nine ,, Rs. 15 ,, ...	135
Two saw dust coolies at Rs. 10 each	20
One watchman	15
Total staff ...	730
Total per annum ...	8,760

Operating costs.

	Per annum.
	RS.
Staff	8,760
Fuel—saw mill waste--no charge.	
Saws, belts, oil, spares, maintenance, repairs, etc.	6,083
Overheads—	
Supervision—	
Share of Forest Engineer in charge, Saw Mills and Extraction.	3,000
Share of Chief Forest Engineer	500
Depreciation—	
10 per cent on Rs. 20,170 ... ... 5 per cent on Rs. 8,450	} 2,440
Interest 6 per cent on Rs. 28,620	1,717
Total operating cost ...	22,500

Estimated annual outturn---60,000 cubic feet.

Cost of sawing As. 6 per cubic foot.

207. The anticipated returns from each mill will be considered separately, as the cost of logs delivered at the mill varies. The price received varies considerably depending upon species and size of material sawn. At present the *average* price at railway station for all deciduous scantlings, excluding teak, is about Rs. 3; for evergreen scantlings, Rs. 2-12-0; for sleepers, excluding teak, Rs. 2-11-9.

Anamalais Saw Mill.

	PER C. FT.		
	RS.	A.	P.
Cost of sawn material in log, with logs at As. 10 per cubic foot and 60 per cent conversion.	1	0	8
Cost of sawing	0	6	0
Cost of delivery to the railroad at Pollachi	0	8	0
Handling (includes sales depot charges)	0	1	0
Total cost of sawn material ...	1	15	8
Average price anticipated ...	2	12	0
Profit ...	0	12	4

Annual profit on 60,000 cubic feet—Rs. 46,250.

Begur Saw Mill.

	Rs.	A.	P.
	PER C.FT.		
Cost of raw material with logs at Re. 0-8-0 per cubic foot and 60 per cent conversion.	0	13	4
Cost of sawing	0	6	0
Handling (sales depot)	0	1	0
Cost of carting to Nanjangode	0	10	0
Total cost sawn material ...	1	14	4
Average price anticipated ...	3	0	0
Profit ...	1	1	8

Total annual profit on 60,000 cubic feet—Rs. 66,250.

North Mangalore or Nilambur Evergreen Saw Mill.

	Rs.	A.	P.	Rs.	A.	P.
				PER C.FT.		
Cost of raw material with logs at Re. 0-10-0 per cubic foot and 60 per cent conversion.				1	0	8
Cost of sawing				0	6	0
Handling (sales depot)				0	1	0
Cost of delivery to rail—						
North Mangalore	0	8	0			
Nilambur	0	2	8			
Say, an average of ...				0	5	4
Total cost ...				1	13	0
Average price anticipated ...				2	12	0
Profit ...				0	15	0

Total annual profit on 60,000 cubic feet—Rs. 56,250.

208. To supply logs to the Kal Ar Valley saw mill a skidder will be required. As the topography is very steep and rough, a Twin-Fordson three-drum slack-line skyline machine is recommended. This will cost Rs. 23,000 complete—Rupees 16,000 for skidder with two Fordson engines and Rs. 7,000 for wire rope, blocks, tackle, etc. In addition, felling and bucking saws and wedges costing Rs. 2,000 will be required. Total capital cost logging equipment—Rs. 25,000.

This equipment will handle the 100,000 cubic feet of logs required by the mill annually with ease and is capable of doing it in seven months. Delivery to the mill from skidder setting will be by country carts on contract.

209. The cost of logging, based on similar operations in Chenat Nair Reserve, is estimated as follows:—

	Rs.	A.	P.	Rs.	A.	P.
				PER C.FT.		
Felling and bucking				0	0	6
Skidding				0	2	6
Carting to mill				0	1	0
Overheads—						
Interest at 6 per cent on Rs. 25,000	0	0	3			
Depreciation at 10 per cent on Rs. 25,000	0	0	5			
Direction charges, staff, etc. *	0	3	4			
Share—Road construction and planning	0	2	0			
Total overheads ...				0	6	0
Total cost of logs per cubic foot delivered at mill ..				0	10	0

Annual recurring expenditure based on outturn of 100,000 cubic feet of logs —Rs. 58,330.

* Includes pay of staff during mon-soon shut-down.

210. Similar logging equipment to that recommended for Kal Ar Valley, Anamalais, is proposed for getting out logs to supply the saw mill which will be established in either North Mangalore division or at Nilambur. Cost of logs delivered at the mill will be approximately the same.

211. A skidder is also recommended for logging the clear-felled area in the Wynad. An M.A.C. Fordson two-drum high lead skidder is recommended for this work. Capital cost will be as follows:—

	RS.
M.A.C. Hoist 'B' f.o.b. factory	1,820
Freight (water and rail)	322
Customs, clearing, etc.	821
Fordson engine	1,995
Transport to site	42
Total skidder ...	5,000
Wire rope	2,000
Blocks, rigging tackle, etc.	1,000
Mounting on sled	400
Total skidder erected and rigged ...	8,400

Felling and bucking saws, axes, wedges, etc., to the value of Rs. 1,600 might be included, bringing the total cost of Wynad clear-felled area logging equipment to Rs. 10,000.

With the cheaper machine, a saving of three-fifths in interest, depreciation and upkeep over Anamalais cost figures and easier topographic conditions should bring the cost of logs delivered at the mill to Re. 0-8-0 per cubic foot in the Wynad.

212. In order that we may be freed from dependence on cartmen, the use of mechanical transport for delivering logs at Olavakkot saw mill is proposed for 1928-29. Carts have always been a problem at Olavakkot and the seasonal variation in numbers available is often a serious handicap. Also the cost of transporting logs to the mill can be reduced by the mechanical methods proposed. The capital cost of transport equipment will be as follows:—

	RS.
Super-sentinel steam wagon with steel wheels and reduction gears.	14,000
Four log trailers, 8-ton capacity, at Rs. 3,000	12,000
Oil, grease, spares, sheds	2,000
Total ...	28,000

Daily running charges.

	RS.	A.	P.
Interest at 6 per cent on Rs. 28,000 (200 working days a year).	8	6	0
Depreciation at 10 per cent as above	14	0	0
Fuel—one ton wood	5	0	0
Maintenance	6	0	0
Tyres	12	0	0
One driver on Rs. 75	3	10	0
One fireman on Rs. 30	1	8	0
Two brake coolies on Rs. 15	1	8	0
Total running cost per day ...	52	0	0

The trip from Olavakkot saw mill to Elival, where logging will be going on, will take one hour; the return trip loaded with two trailers, each carrying 250 cubic feet of logs, two hours. Two trips a day will deliver 1,000 cubic feet of logs to the mill. The cost per cubic foot for transport will therefore be 10 pies. At the present time carting over the same distance costs 3 annas per cubic foot. Mechanical transport will thus result in a saving of 2 annas a cubic foot as well as guaranteeing uninterrupted delivery of logs to the saw mill.

213. To use mechanical transport on the Olavakkot-Elival road will necessitate eliminating the sharp curves. This will cost, the Forest Engineer estimates, Rs. 4,000, and this amount will be provided as capital expenditure on roads.

214. *Recapitulation of proposed expansion in 1928-29—*

Unit.	Initial capital cost.	Annual recurring expenditure.			Annual net profit.
	RS.		RS.	RS.	RS.
		Saw Mill	18,343	..	
Anamalais (Kal Ar Valley) Saw Mill	28,620	Carting and Handling.	33,750	..	
				52,093	46,250
Logging equipment to supply same..	25,000	Logging	..	58,330	
		Saw Mill	18,343	..	
Begur Saw Mill (Logs supplied departmentally, best logs sold in the round, others to mill. Cost of logs to Mill—Rs. 50,000).	28,620	Carting and Handling.	41,250	..	
				59,593	66,250
		Saw Mill	18,343	..	
North Mangalore or Nilambur Evergreen Saw Mill.	28,620	Carting and Handling.	23,750	..	
				42,093	56,250
Logging equipment to supply same..	25,000	Logging	..	58,330	..
Quarters for staff at New Mills	10,000				
Total new plants ..	1,45,860	Total new annual running expenditure.		2,70,439	* 1,68,750
Skidder for clear felled area in Wynad	10,000			5,930	
Mechanical transport for Olavakkot..	28,000				
Total Capital investment 1928–29 ..	1,83,860				

* Profit from three new plants only.

(3) 1929-30.

215. The principal development proposed for 1929-30 is the establishment of a ply plant for the manufacture of veneers, ply wood tea boxes, etc., and a small saw mill at what will eventually be the Papanasam Forest Industries centre, together with the necessary logging equipment to get out the raw material. The strides which are being made by the North Indian Syndicate which has already put up to Government of Madras proposals to establish a pulp and paper mill at Papanasam, utilizing Eta reed as raw material, indicates that by 1929-30 we can start building what is expected to be the most profitable forest utilization project yet proposed. If Government accepts the proposals of the Syndicate by the time we are ready to operate the ply plant, cheap hydro-electric power will be available, with rail transport from the plant site. The saw mill may have to be built even earlier to provide construction material for the pulp and the paper mill and the impounding dam and hydro-electric plant.

216. Reference has already been made in this report to the enormous demand for ply wood tea boxes and other veneer products. In Papanasam Forest Reserve and the adjoining forests are ample quantities of timber suitable for ply wood. Plenty of good labour is available as the experience of the cotton mills in that district testifies.

217. With an abundant supply of raw material, cheap power, good labour, rail transport, and an assured market, we have at Papanasam all the essentials for a successful industrial enterprise.

218. The plant proposed is that recommended by the Company which has equipped practically all the plants in Finland which are manufacturing tea chests for India (which are shipped via the United Kingdom), as well as the Acme Tea Chest Company of Glasgow and Messrs. Venesta, Limited, of London, and others.

Veneer and Ply Plant.

Veneer cutting equipment.

Item 1. *Drag Saw.*—One (1) direct acting steam drag saw machine with stationary base and hand hoist, 6″ bore, 30″ stroke, with one 10″ × 7′ × 8 gauge Tuttle tooth saw. Approximate gross weight, 1,670 lb. Approximate measurement, 75 cubic feet.

Item 2. *Log Trolley and Hoist.*—One (1) plain type trolley with quick lifting hoist, 4,000 lb. capacity. Approximate gross weight, 258 lb.

Item 3. *Rotary Veneer Lathe.*—One (1) Rotary cutting machine or lathe 66″ long, to take logs up to 42″ in diameter and 66″ in length. Furnished complete with main knife, two pairs of chucks, six scoring knives, standard gear equipment including eight gears producing fourteen thicknesses of veneer from $\frac{1}{72}$ inch up to $\frac{3}{8}$ inch inclusive. Approximate gross weight, 19,250 lb. Approximate measurement, 570 cubic feet.

Item 4. *Auxiliary Table.*—One (1) auxiliary chain table for use between lathe and clipper, 20′ long, 66″ wide, complete with clutch pulley. Approximate gross weight, 4,000 lb. Approximate measurement, 50 cubic feet.

Item 5. *Veneer Clipper.*—One (1) veneer clipper power and hand feed 66″ wide, furnished complete with one 66″ clipper knife on machine, and 12′ chain clipper table. Approximate gross weight, 5,000 lb. Approximate measurement, 240 cubic feet.

Item 6. *Veneer Knife Grinder.*—One (1) automatic veneer knife grinder, 66″ size, furnished complete with one emery grinding wheel. This machine is suitable for grinding the knives used on the above clipper and lathe. Approximate gross weight, 4,800 lb. Approximate measurement, 200 cubic feet.

Item 7. *Roller Veneer Dryer.*—One (1) automatic roller veneer dryer, eight sections long, four pairs of rolls high, rolls spaced on 7″ centres. Total gross length of the dryer 52′ 6″ (including one feeding end and one cooling end, each 5′ 3″ long). Capacity of dryer when 100 per cent full 2,015 square feet per load; when 80 per cent full 1,612 square feet per load; dryer requires 70 Boiler horsepower to operate.

Equipment.—Drive rig with electric motor for driving; one chain tightener; one fan with heater coils; one electric motor for fan; galvanized iron air ducts. Steam traps for all the coils; one pump and receiver to return the condensate to the boiler; belts for motors; insulation for dryer fan; and air ducts; also valves and fittings for connecting the steam coils to the traps.

Approximate gross weight 110,150 lb. Approximate measurement, 2,185 cubic feet.

Capacity.—This dryer will dry one load of veneer $\frac{1}{16}$″ or $1\frac{1}{2}$ m.m. thick in 17 minutes when using steam at 100 lb. steam pressure and driving the veneer to 9 per cent moisture content. Figuring on having 80 per cent of the area of dryer covered, the capacity in eight hours will be 45,200 square feet of $\frac{1}{16}$″ veneer, 135,500 square feet in twenty-four hours. If the veneer is to be dried to 3 per cent moisture content on the above basis, it would take 19 minutes to dry one load, and the eight hour capacity will be 40,700 square feet or 12,000 square feet in twenty-four hours. The capacity in cubic meters in twenty-four hours when drying to 9 per cent moisture content, would be 20.7 c. meters, or drying to 3 per cent moisture content 17.6 c. meters in the same length of time. Other thicknesses will dry in direct proportion to the above up to $\frac{1}{4}$″.

Glue Room Equipment.

Item 8. *Glue Cookers or Mixers.*—Two (2) glue cookers or mixers, 50 gallon capacity. These mixers are suitable for mixing cold glues or preparing glues that require heat. Approximate gross weight of each, 1,100 lb. Approximate measurement, 42 cubic feet.

Item 9. *Glue Spreader.*—One (1) power-feed glue spreader, 53″ size, double style for applying the glue to both sides of the veneer sheet in one operation.

Item 10. *Electric Veneer Press.*—One (1) electric veneer press, 60″ long, 48″ wide and 48″ vertical opening, 150 lb. maximum pressure per square inch on platen surface, complete with motor and electric control. Approximate weight, 10,800 lb. Approximate measurement, 360 cubic feet.

Item 11. *Retaining Clamps.*—Fifty (50) sets retaining clamps for use with single "I" Beam Retainers, for use in connection with the press described above. Approximate weight, 1,250 lb.

Finishing Equipment.

Item 12. *Veneer Jointer.*—One (1) direct motor driven veneer jointer, complete with two motors and electric control equipment, 6 feet machine. Approximate weight, 3,800 lb. Approximate measurement, 131 cubic feet.

Item 13. *Veneer Taping Machine.*—One (1) veneer taping machine, complete with motor latest improved type, with electric warm air drying attachment. Approximate weight, 2,150 lb. Measurement, 105 cubic feet.

Item 13 (*a*). *Veneer Tape.*—One thousand (1,000) pounds veneer tape, one inch wide, gummed for use on the above veneer taping machine. Approximate gross weight 1,300 lb.

Item 14. *Sizer.*—Two (2) double cut-off saws, one furnished for cross-cutting and one for ripping the panels to the exact length and width desired. Approximate gross weight of both, 5,000 lb. Approximate measurement, 140 cubic feet.

Item 15. *Two Drum Sander.*—One (1) two drum sander, 30″ wide. Approximate weight, 3,900 lb. Approximate measurement, 110 cubic feet.

Item 16. *Extra Veneer Knives.*—(*a*) Three (3) extra veneer lathe knives, 66″ long, for use on the veneer lathe, item 3.

(*b*) Three (3) extra veneer clipper knives, 66″ long, for use with veneer clipper, item 5 (two-piece knives).

(*c*) Six extra emery wheels for use on veneer knife grinder, item 6.

219. *Capital cost of veneer and ply plant.*—

		RS.
Cutting, drying, gluing and finishing equipment, f.o.b. factory.		97,756
Freight to nearest railway station		14,377
Customs and clearing		37,378
Total veneer machinery ...		1,49,511
Electric motors (total 100 H.P.) control equipment and wiring, delivered.		15,000
	RS.	
Steam boiler, delivered	7,900	
Brick work, stacks, etc.	2,100	
		10,000
Transport to site and erection		13,000
Building		50,000
Total ...		2,37,511
Add 5 per cent contingencies ...		11,876
		2,49,387
say ...		2,50,000

220. *Estimated outturn.*—

Daily input of logs	900 cubic feet.
,, outturn of lathe	600 ,,
,, ,, of dryer	120,000 square feet.
Equal to 3-ply	40,000 ,,
Waste in trimming, shrinkage, etc.	14,000 ,,
Outturn ...	26,000 square feet 3-ply per day.
Equivalent to ...	1,200 tea boxes 19 × 19 × 24.
Monthly outturn (average 20 days a month)	520,000 square feet or 24,000 boxes.
Yearly outturn	6,240,000 square feet or 288,000 boxes.
For conservatism we will base our calculations on an outturn of	240,000 boxes per annum.

221. *Cost of staff required for veneer plant.*—

	Per mensem. RS.
Proportion of pay of officer in charge	750

Note.—One officer in charge on Rs. 1,500 per mensem distributed as follows:—

	RS.
Logging	500
Saw mill	250
Veneer plant	750

Proportion of office staff 150

Note.—Office will consist of:—

	RS.
One head clerk on	100
One accountant on	60
Two clerks on Rs. 50 ...	100
Peons	40
Total ...	300 per mensem.

Distributed.—

	RS.	RS.
Logging	100	
Saw mill	50	
Veneer plant	150	
One foreman		500
One master mechanic		100
Twelve skilled workmen on Rs. 50		600
Fifty-six unskilled workmen on Rs. 15		840
Total ...		2,940

or Rs. 35,280 per annum.

222. *Annual cost of production*—

		Per annum.
		RS.
(*a*) Operating cost—		
Staff, Rs. 2,940 per month		35,280
Power (Electric) 100 H.P. or 74·6 K.W. at Rs. 50 per K.W. annum.		3,730
Extra fuel for Boiler		7,200
Supplies, stores, repairs, etc.		11,990
Total Operating cost ...		58,200
	RS.	
(*b*) Overheads—		
Depreciation on Plant, 5 per cent on Rs. 2,50,000 ...	12,500	
Interest on investment in Plant and Working Capital—6 per cent on Rs. 3,05,000.	18,300	
Share direction—Forest Engineering Branch	3,900	
Total Overhead ...	34,700	34,700
(*c*) Raw material—		
Logs, 216,000 cubic feet at Re. 0-10-0		1,35,000
Vegetable glue, 139,000 lb. at Re. 0-6-0		52,100
Total ...		1,87,100
Grand total—Annual cost of production ...		2,80,000

	RS.	A.	P.
Cost per square foot on 52 lakhs square feet outturn	0	0	10
Cost of ply wood in one tea box 19×19×24 based on outturn of 2·4 lakhs boxes.	1	2	8
Cost of battens 25,344 cubic feet of battens supplied by saw mill at Rs. 1-7-0 per cubic foot will be cut from veneer cores as well as saw mill trimmings and edgings. Cost of 0·088 cubic foot battens in one tea box.	0	2	0
Total cost wooden material in one tea box ...	1	4	8

223. The lead foil and metal strips used will cost Rs. 1-3-0 per box, making the total cost at the mill Rs. 2-7-8 or say Rs. 2-8-0 on rail. The average cost of a tea box in the Anamalais Planting district is Rs. 4-8-0; in Calicut Rs. 4-0-0. We would probably have to undersell the imported boxes in order to get established on the market, say at Rs. 3-8-0 per box f.o.r. mill. Since our product would be identical with the imported boxes, as soon as the planters were convinced of that fact through experience, we could command a higher price. Of course, the whole outturn of the plant would not go into tea boxes. Three, five, and seven ply panels and other ply wood products would be made, and while the selling price of these is not available, the profit would certainly be greater than on the same quantity of material in tea boxes. However for the purpose of estimating financial returns on the veneer plant we will consider only the tea box basis :—240,000 boxes per annum selling at Rs. 3-8-0, cost Rs. 2-8-0, net profit Re. 1-0-0 or

Rs. 2,40,000 per annum. With our product established on the market we may expect a price of Rs. 3-12-0 to Rs. 4-0-0 or a profit of Rs. 1-4-0 to Rs. 1-8-0 per box, giving a net annual return of Rs. 3,00,000 to Rs. 3,60,000. Of the average net profit of say Rs. 3,00,000 per annum, 9.7 per cent or Rs. 29,100 should be credited to the saw mill as profit on battens supplied, and 90.3 per cent or Rs. 2,70,900 to the ply plant.

224. *Papanasam Saw Mill.*—The saw mill would be similar to those already described in this report and needs no repetition of details. Instead of a steam engine, individual electric motors on each machine would supply the power and belting and shafting eliminated. An extra bolter for cutting battens out of veneer cores and a band resaw as described in paragraph 241 would be added. The total capital cost of mill proposed is Rs. 40,000.

225. Annual operating cost is estimated as follows:—

	Per annum. RS.
Saw mill staff	10,920
Saws, spares, repairs, etc.	3,340
(NOTE.—Cost of engine oil and belts eliminated.)	
Power (Electric)	2,240
Share of salary of Officer-in-charge	3,000
Share of office staff	600
Share of direction—Forest Engineering Branch	500
Depreciation—$7\frac{1}{2}$ per cent on 40,000	3,000
Interest—6 per cent on 40,000	2,400
Total annual operating cost ...	26,000

226. The yearly outturn of the sawn material will be less than that of mills cutting sleepers and other large-sized material owing to the large number of 1″ × 1″ battens required for tea boxes and to the fact that much of the outturn will be principally of the more valuable woods like Gluta tranvancorica cut into sizes suitable for furniture and cabinet makers and for export. Assuming a yearly outturn of 55,000 cubic feet (25,000 cubic feet battens and 30,000 cubic feet of sawn lumber) the cost of sawing would be Re. 0-7-7 per cubic foot.

227. On a basis of 60 per cent conversion the mill would require 92,000 cubic feet of logs. Of this 36,000 cubic feet would be suplied by cores from the veneer plant (the inner portion of the log left held by the chucks of the veneer lathe after all the veneer possible has been peeled off.) These cores would be cut into battens on the bolter. Since the cost of these in the log has been paid for by the veneer plant, they would be charged to the saw mill only at the cost of handling, say, 6 pies per cubic foot. We have then, for the cost of raw material at the saw mill—

	RS.
36,000 cubic feet at Re. 0-0-6	1,125
56,000 „ „ 0-10-0	35,000
Total ...	36,125
Log cost per cubic foot of sawn material ... ... Re.	0-10-6

228. In connection with the saw mill a two chambered dry kiln with truck charging would probably be required. This would cost Rs. 40,000 complete erected. Based on experience at Olavakkot, the cost of seasoning would be 4 annas per cubic foot. The installation proposed would have a capacity of all the mill outturn.

229. The total cost of the saw mill product is therefore—

	Per cubic foot. RS.	A.	P.
Raw material cost	0	10	6
Sawing cost	0	7	7
Kiln drying cost	0	4	0
Yard handling, storage and loading	0	0	11
Total ...	1	7	0

230. The revenue that may be expected from the produce of the saw mill is—

	RS.
Profit from tea box battens (see para 223)	29,100
Profits from lumber selling at Rs. 3 to Rs. 4 per cubic foot. Taking lowest figure for conservatism.	...
Profit Rs. 1-9-0 per cubic foot on 30,000 cubic feet	46,900
Waste sold as fuel 24,000 cubic feet — at Re. 0-1-0 ...	1,500
Total annual net profit ..	77,500

Papanasam Logging.

231. The quantity of logs to be extracted annually from Papanasam Forest to supply the veneer and ply plant is 216,000 cubic feet and for the saw mill 56,000 cubic feet, total 272,000 cubic feet. On a basis of ten months' work and 20 days a month, equipment to extract an average of 1,360 cubic feet a day is required.

232. The pulp and paper mill engineers propose to use electrically operated ropeways for transportation of eta reed to the lake formed by the hydro-electric dam. As the topography is rough and great elevations must be overcome, in short distances, ropeways (electrically operated) for the main log transport are also proposed. Yarding of logs from stump site to ropeway may be done by a multiple drum skidder using the high lead method for logging uphill, and the slack line skyline system for downhill yarding. Although the first cost of an electric skidder is greater than that of a steam or internal combustion powered machine, the operating cost is so much lower that the electrical machine is advocated. Calculations based on American electric logging experience modified to fit conditions at Papanasam indicate a power cost of only .067 of a pie (Re. 0-0-0.067) per cubic foot logged. This figure is obtained as follows :—

Net power consumption 9.5 K.W.H. per 1,000 cubic feet logged. Transmission and transformer losses 1.6 K.W.H. Gross power consumption 11.1 K.W.H. per 1,000 cubic feet logged. Buying power on an annual basis of Rs. 100 per K.W. year, it would cost 0.5 anna on a 40 per cent load factor or 0.5 × 11.1=5.6 annas per 1,000 cubic feet, or 0.076 pies per cubic foot.

233. *Capital cost of logging equipment*—

	RS.
One Electric Multiple drum skidder complete with transformer, cable, etc.	50,000
Wire rope, blocks, etc., for same	10,000
Five miles main ropeway, electrically operated at Rs. 20,000 per mile	1,00,000
One mile branch swing ropeway, portable	25,000
Power station for operating ropeways	60,000
Felling and bucking saws, axes and wedges	5,000
Total ...	2,50,000

234. The logging staff would be similar to that required in other skidder logging operations, except that the logging superintendent would be an electrical engineer trained in logging at Chenat Nair, on a salary of probably Rs. 750 per mensem. Two men of Ranger grade and three of Forester grade would make up the balance of the executive staff. One-third of the pay and office establishment of the officer in charge of Papanasam Forest Industries centre is charged to logging.

Cost of extracting logs, Papanasam—

	Per cubic foot. RS.	A.	P.
Felling and bucking	0	0	6
Yarding or skidding	0	2	0
Transport to mill	0	3	5
Overheads—			
Interest and depreciation	0	2	10
Supervision	0	1	3
Total cost, logs delivered at veneer plant and saw mill	0	10	0

235 (*a*) *Quarters for staff, Papanasam Forest Industries centre.*—The cost of building quarters to house the staff employed in the veneer and ply plant, saw mill and logging operations will have to be included in the budget. Since this investment will be recovered in the form of rentals, the cost is not properly chargeable against outturn.

	RS.
Estimated cost of quarters to house—	
One officer-in-charge	22,000
One logging superintendent	18,000
Three foremen	24,000
Six clerks (including one head clerk)	17,000
Seventy skilled workmen	60,000
One hundred and seventy-eight unskilled workmen and coolies.	89,000
Total, Quarters ...	2,30,000

236. *Summaries*—

Summary of cost of Papanasam Project.

	Initial capital cost.	Annual recurring expenditure.
	RS.	RS.
Veneer plant	2,50,000	1,10,300
Saw mill and dry kilns	80,000	33,200
Logging	2,50,000	1,21,890
Quarters for staff	2,30,000	.
Total ..	8,10,000	2,65,390

Summary of profits expected.

	RS.
Veneer and ply plant	2,70,900
Saw mill	77,500
Logging—supplies raw material at cost	...
Total Annual profit ...	3,48,400

(3) (*b*) *Pollachi Saw Mill.*

237. It is anticipated that by 1929-30 the large surplus stocks of logs in Pollachi depot will have been cut up and the Pollachi saw mill will then be moved to Top-slip in the Mount Stuart Forests near the source of log supply. By this move, approximately Re. 0-6-0 a cubic foot will be saved (the cost of carting logs from Top-slip to Pollachi). The sawn material will still have to be carted, but the saving in waste haulage will mean a profit of about 3 annas more on every cubic foot of lumber produced.

238. The cost of the move to Top-slip will have to be included in the budget of capital expenditure and will approximate Rs. 5,000, including cost of erecting new mill and storage sheds.

239. Extraction from Karian Shola may be necessary because the Conservator of Forests, V Circle, proposes to restrict the area felled in the deciduous forest of Mount Stuart to a point where the log supply will be insufficient for the saw mill. Only sufficient timber will be extracted from Karian Shola to make up the balance of the mill requirements.

240. With the establishment of the saw mill at Top-slip, extraction in Karian Shola is proposed. This evergreen forest has never been worked, although a number of sample plots have been felled for regeneration experiments. For logging this area a two-drum Fordson high-lead skidder, the same as proposed for Wynad (1928-29), is recommended. The total cost of logging equipment for Karian Shola as detailed in Wynad proposals is Rs. 10,000. With a shorter haul to the mill, the cost of logging Karian Shola should be an anna less than that estimated for the Wynad or 7 annas per cubic foot.

241. The demand for boards being apparently on the increase, and a band resaw being required for efficient production of boards, with the removal of the Pollachi saw mill to Top-slip, the addition of a band resaw is recommended. A band resaw for one of the Wynad mills (Begur or Chedleth) and for one of the

South Kanara mills (Parappa or North Mangalore) may also be required. The inclusion in the five-year programme of three band resaws is therefore proposed. Capital cost of each resaw, complete with saws, saw sharpening machine and necessary belts, pulleys, countershafting, etc., is estimated at Rs. 8,000 for each installation, or a total of Rs. 24,000.

The extra staff required on each machine (one resawyer on Rs. 50, one helper on Rs. 30, three-feeder helpers and off bearer coolies on Rs. 20, total Rs. 140 per mensem, or Rs. 1,680 per annum) will be offset by savings in overhead cost per cubic foot due to increased outturn of the mill, and by the greater value of the product turned out.

(4) 1930-31 and 1931-32.

242. The next two big developments proposed are Someshwar-Andar (South Kanara) and New Amarampalam (Nilambur, Malabar). There is sufficient raw material available in the areas tributary to both these centres to supply a veneer and ply plant and a saw mill in perpetuity on a sustained yield basis. Nilambur is at present the more favourably situated as regards railway facilities with the new line from Shoranur approaching completion. There is talk of building a branch of the Mysore Railway through South Kanara to the Coast in order to provide a sea outlet for the produce of Mysore. This would materially aid the proposed Someshwar project. Both Nilambur and Someshwar are in a favourable position for export trade, the former being 45 miles from Calicut port and the latter 34 miles from Coondapoor Port and 57 miles from Mangalore.

243. Accurate enumerations already made in Someshwar show a stand of evergreen and mixed deciduous timbers suitable for veneer and ply wood as well as construction lumber averaging 500 cubic feet per acre (see Chapter II, Section A). Preliminary mapping and cruising in New Amarampalam Reserve is just starting, but it is believed that an even heavier stand of the same type forest exists.

244. During the final two years of the present five-year programme, we will probably be able to establish only one of these projects. There is also a possibility of private interests taking up Someshwar before 1932. For the purpose of estimating capital cost of the proposed five-year expansion programme, we will therefore consider the cost of only one project. Conditions in the two being quite similar, a plant is proposed which will be suitable for either Someshwar Andar or New Amarampalam.

245. *Capital cost of one project—Manufacturing plant—*

	RS.
(1) A veneer and ply plant similar to that proposed for Papanasam in 1929–30 except steam powered— Cost erected ...	2,50,000
(2) A band saw mill (similar to that at Olavakkot) to turn out 100,000 cubic feet annually	1,50,000
(3) A battery of eight dry kilns to season the entire mill outturn.	1,00,000
(4) One Sentinel steam road wagon and four trailers for delivering output of ply plant and mill to shipping point	26,000

246. *Logging equipment to extract* 400,000 *cubic feet of logs per annum—*

One high lead side.

	RS.
1 High lead steam skidder, cost f.o.b. factory	7,500
Wire rope for same—	
1,200 feet $1\frac{1}{8}''$ main line	} 3,990
3,000 feet $\frac{5}{8}''$ haul back	
3,000 feet $\frac{3}{8}''$ slack line	
1,200 feet $1\frac{1}{8}''$ guy line	
Blocks	1,800
Rigging...	1,800
Total f.o.b. factory ...	15,090
Freight	2,510
Customs and clearing, etc.	5,770
Total delivered ...	23,370
Sled, pipe, tools, oil, etc.	8,400
Water pump	2,730
Total side ...	34,500

	Cost f.o.b. factory.
	RS.
One skyline side—	
One slack line skyline skidder	10,000
Wire rope for same, 2,000 feet, one 1/8 inch main line, 4,000 feet, one inch haulback, 3,000 feet, 3/8 inch straw line, 2,500 feet, $1\frac{1}{4}$ inches skyline, 2,400 feet, 1 inch guy line.	7,970
Blocks	2,490
Rigging	2,250
Total f.o.b. factory ...	22,710
Freight ...	3,800
Customs and clearing, etc. ...	8,790
Total delivered ...	35,3(0
Sled, pipe, tools, etc.	8,470
Water pump	2,730
Total side ...	46,500
Total skidding equipment ...	81,000
Felling and bucking equipment	8,000
Log transport equipment—	
One sentinel, steam wagon (as proposed for Rs. 28,000 Olavakkot 1928–29)	
Eight road trailers ... ... „ 24,000	
Total Transport equipment ...	52,000
Telephone equipment to connect logging operation with mills, ten miles at Rs. 700 per mile.	7,000
Grand total—Logging equipment ...	1,48,000

247. *Estimated operating costs*—

	RS.	A.	P.	Per cubic foot. RS.	A.	P.
Logging—						
Felling and bucking				0	0	6
Skidding				0	2	0
Transport				0	1	0
Overheads—						
Direction	0	0	6			
Interest and depreciation ...	0	2	0			
Road cost	0	1	0			
Total overheads ...				0	3	6
Total logs delivered at mill and ply plant ...				0	7	0

Note.—Overheads are less per cubic foot than in other logging operations given in this report, due to larger outturn. Skidding is cheaper because

(1) fuel cost with steam engines is less than internal combustion engines,
(2) the machines are more powerful and output with same crew is greater, and
(3) depreciation with steam machinery is less.

248. *Estimated returns on saw mill (overheads included)*—

	Per cubic foot. RS.	A.	P.
Conversion (sawing)	0	5	0
Kiln drying	0	3	0
Raw material—Logs at 7 annas with 60 per cent conversion ...	0	11	7
Yard handling	0	0	5
Total cost per cubic foot of sawn material at the mill ...	1	4	0

Note.—Despite fuel costs, doubled outturn makes sawing and kiln costs less than Papanasam.

The cost of delivery to shipping point will be less than an anna in the case of Nilambur and probably 4 annas at Someshwar. Taking the latter figure, brings the total cost to Rs. 1-8-0. We may expect to get a minimum of Rs. 2-8-0 for sawn material, or a profit of Re. 1 per cubic foot on an annual outturn of 75,000 cubic feet or Rs. 75,000. On 25,000 cubic feet of battens supplied to the ply plant, a profit of Rs. 27,600 will be made. Total annual profit on saw mill, Rs. 1,02,600.

249. *Estimated returns from Veneer and Ply Plant.*—Owing to the use of steam instead of electricity manufacturing costs will be higher than at Papanasam. Cost of glue will be greater owing to additional transport cost to mill. However there is a large saving in the cost of logs due to easier extraction. Following is the summary of annual total costs:—

	RS.
Raw material—	
Logs	1,00,000
Glue	53,300
Operation	72,000
Overheads (interest, depreciation, direction), etc.	34,700
Total cost ...	2,60,000

	RS.	A.	P.
Cost of ply wood in one tea chest based on annual outturn of 2·4 lakhs chests.	1	1	4
Cost of battens	0	1	9
Total cost wooden material at plant ...	1	3	1
Lead foil and metal strips	1	3	0
Total cost tea chest ...	2	6	1

Delivery to rail from Someshwar plant would bring the f.o.r. cost to Rs. 2-8-0, while from the Nilambur plant the f.o.r. cost would be Rs. 2-6-6. Although rail freight to the consumer would be a little more than from Papanasam, the general level of prices would be higher due to our product having been already established on the market by the Papanasam plant. We may therefore anticipate the same annual net profit as that expected from Papanasam veneer and Ply plant, viz., Rs. 3,00,000. This profit will be credited 9.2 per cent to the saw mill and 90.8 per cent or Rs. 2,72,400 to the ply plant.

250. *Summaries*—

Summary of cost of Someshwar or Nilambur project.

	Initial capital cost.	Annual recurring expenditure.
	RS.	RS.
Veneer and ply plant	2,50,000	1,60,000
Saw mill	1,50,000	50,000
Logging	1,48,000	87,500
Roads	60,000	25,000
Quarters for staff	3,00,000	...
Total ...	9,08,000	3,22,500

Summary of profits expected.

	RS.
Veneer and ply plant	2,72,400
Saw mill	1,02,600
Total annual net profit ...	3,75,000

F. Logging Engineering Programme.

251. The areas in which valuation surveys must be now made and the fundamental data on topography and timber stand obtained to enable extraction operation plans to be prepared in advance are as follows :—

Areas to be mapped and cruised and operation plans prepared.

Forest.	Exploitable Acreage.
Anamalais—Kal Ar Valley...	23,000
New Amarampalam Reserve, Nilambur (total 55,752 acres) ...	...
Papanasam reserve, Tinnevelly	5,966
Andar Reserve, South Kanara—Heavy forest adjoining Someshwar (total 40,000 acres).	5,000
Silent Valley, Malabar	11,060
Attipadi	25,190
All areas in South Mangalore division supplying logs to Parapa Saw Mill.	...

Operations areas will supply.

The Kal Ar Valley is being clear felled for cinchona planting and will supply logs to the portable saw mill which is recommended for establishment there in 1928-29. New Amarampalam Reserve will supply the Nilambur saw mill and plywood plant proposed for 1930--31, as well as the export remanufacturing and veneer plant proposed to supply the 'Arabian and African markets. Papanasam Reserve will furnish the raw materials for the Papanasam Forest Industries centre scheduled for 1929-30, and Andar Reserve will be connected with the Someshwar Project. Attipadi and Silent Valley will supply the Olavakkot saw mill after logging operations in Chenat Nair Reserve have finished.

Possible additional work.

252. In addition to mapping and cruising, surveys of roads and ropeways in all the above areas, etc., will devolve upon the Logging Engineering division. There is also a possibility that we will be called upon to do the logging engineering work for Makut, Coorg, which is about to be revived with the backing of the Railway Board. This will include mapping and cruising of 3,800 acres and tramway surveys. Some work in the Wynad may also be required.

253. The tentative programme of work for the Logging Engineering division for the next five years is as follows :—

Yearly programmes.

	Field parties.
1926-27 (Winter field work season).	
Start mapping and cruising in New Amarampalam Reserve ...	3
Mapping and cruising and surveying in Kal Ar Valley, Anamalais (for hand-sawing sleeper operations).	1
Mapping and cruising in north portion of Andar Reserve adjoining Someshwar.	2
1927-28.	
Continue mapping and cruising in New Amarampalam Reserve ...	3
Topog. mapping logging area—Papanasam Reserve	3
Mapping and cruising, preparation of logging plans, road surveys in Kal Ar Valley, Anamalais.	1
Same for supply logs to Nilambur sleeper mill	1
Do. Begur sleeper mill.	
Monsoon office compilation of 1926-27 winter season field data.	
1928-29.	
Ropeway location surveys and preparation of logging plans and laying out same in Papanasam Reserve.	2
Same for Karian Shola (Mount Stuart)	1
Mapping and cruising areas in South Mangalore division to supply Parapa Saw Mill.	1
Continue mapping and cruising in New Amarampalam	2
Do in Kal Ar Valley	1
Start mapping and cruising in Attipadi and Silent Valley	2

1929-30.	Field Parties.
Preparation of logging plans and survey transport roads, and lay-out operations in New Amarampalam.	2
Same in South Mangalore division for Parapa Saw Mill	1
Same in North Mangalore division for Sleeper ,, ...	1
Continue mapping and cruising in Kal Ar	1
Do. in Attapadi and Silent Valley ...	3
Reconnaissance in North Someshwar and Coondapoor Range ...	1
1930-31.	
Preparation of plans and lay out-logging operation in Kallidakode Valley, Chenat Nair Reserve.	1
Same for Amarampalam	1
Same for Papanasam	1
Same for Someshwar Project and Andar	2
Mapping and cruising Attapadi and Silent Valley	4
1931-32.	
Mapping and cruising Attopadi and Silent Valley.	
Preparing further logging plans and laying-out new logging operations in all exploitation areas.	

254. In addition to the programme outlined, the Logging Engineer and his assistants will continue, as in the past, to give technical advice and assistance to all extraction and manufacturing operations.

255. *Logging Engineering Division Staff required—*

1926-27.

The present Logging Engineering division staff will carry on. It consists of 1 acting logging engineer, I head surveyor, 4 rangers, 5 permanent foresters, and 13 probationary foresters or 6 field parties.

Present staff.

The following belonging to the Logging Engineering division are on other duty (Valparai sleeper sawing, etc.):—One ranger, 1 permanent forester, 2 probationary foresters.

1927-28.

(It is presumed that the present Chief Forest Engineer will revert to Logging Engineer and the present acting Logging Engineer to Assistant Logging Engineer with the return of Mr. C. S. Martin, as Chief Forest Engineer.)

Additional staff.

The following increase in staff equivalent to 2 Field Parties will be required:—

One officer (Assistant Conservator or Extra Assistant Conservator).
One surveyor (theodolite operator).
Two rangers (two foresters sent from Forest Engineering Branch to Madras Forest College will return as rangers).
Two clerks.
Six probationary foresters (new men).

It is proposed to revert two permanent foresters to the regular line and replace them with two draftsmen, and to promote six probationary foresters of the 1926-27 staff to permanent grade.

1928-29.

1 *Field Party.*

One officer (Assistant Conservator or Extra Assistant Conservator).
One ranger.
One clerk.
Four probationary foresters.
Six probationary foresters to be promoted to permanent grade.

1929-30.

No increase in staff anticipated.

1930-31.

No increase anticipated.

1931-32.

No increase anticipated.

G. Grading Bureau.

256. In Chapter III (c), paragraph 1, it has been stated that one of the essentials for the successful developing of markets is the introduction of a definite system of grading. Grading is the classification of timber according to its size, quality, freedom from knots, splits, cracks and other defects, in accordance with definite sets of specifications drawn up with due regard to the probable uses of the timber.

257. One of the main reasons why sales of timber in the past have been confined to *local auctions* is the fact that no definite grading system has ever been devised, and this is realised to be almost impossible chiefly owing to the number of species which have to be dealt with and to the fact that many of the species are applied to so many uses, and that the required use of a log will determine its value when defects have to be considered—for example, the long teak poles from the Nilambur forests are of great value in the Arab trade but are worth very little if required for a saw mill—and, again, short sound logs are much in demand for furniture, while such logs are of little value to building contractors when long beams and timbers are required.

258. Hence, log sales will continue to be made by auction except where very large quantities of timber are required by any concern to be utilized for a variety of purposes, when a selection or lot of logs may be sold by tender or bargain with a minimum of girth, length and cubic contents dimensions.

259. But in the question of sawn material or finished article, *grading* is possible and essential as the material can be described and supplied according to specification.

Every saw mill or utilization plant must have attached to it a special subordinate who is trained in grading according to a standard set of grading rules.

260. This is a comparatively simple matter as regards Government saw mills, but it must be assumed that Government does not intend to monopolise the timber trade. This whole report strongly stresses the point that the aim of the Exploitation and Utilization branches of the Forest Department in taking up the work of developing the Presidency's forests is to show the private individual that the lumber industry in South India can be made a paying concern if proper up-to-date exploitation means are employed and definite business organization is introduced. Hence, if markets are developed for South Indian timbers, it may be expected and hoped that private firms will enter the field and build up a sound commercial trade organization.

This question of grading will then become the most important factor in ensuring the success of the undertaking.

261. Again, the vast number of species and their similarity in texture but differences in qualities, is bound to cause distrust in prospective markets. Instances have already come to the notice of the Forest Department of cases where one species of wood of poor quality has been substituted for the one of good quality ordered, with the result that the good species has secured a very bad reputation on the market, which bad impression it is almost impossible to erase.

262. The customer must be able to accept a shipment of timber according to specification without doubt as to its genuineness.

Hence, any questions of doubt in these two questions of correct grading and genuineness, of species must not be allowed to ruin the efforts of the whole Engineering branch by endangering possible markets, for if outside markets are not available, it is not good even considering the increased exploitation of our forests.

263. Other countries which have built up a successful timber trade have been faced with the same problems. The lumber interests of the Pacific Coast of America have combined and have drawn up regular grading rules. Graders have been trained under a standard set by a central bureau called the Pacific Lumber Inspection Bureau, which has issued certificates to qualified men. Every big mill contains one or more of these men and lumber passed out by them is accompanied by an inspection certificate which is recognized by the banking firms and merchants abroad, thus allowing letters of credit to be issued to very nearly the full value of any bill of lading. The Hard-weed Manufactures Association of America has the same organization.

264. The Philippine Islands have now instituted a grading bureau composed of Government Forest subordinates who pass shipments of lumber for export. The exporting mill or firm pays a small percentage to Government for this inspection and receives in return an inspection certificate which again is recognised by banking firms for credit purposes. The whole export trade to Australia is based on this inspection and is insisted on by the Australian Government.

265. Madras has now to face these same problems. It is recommended that this Presidency follows the example of the Philippine Islands and that the Forest Department leads the way until the private lumber interests of South India realise the importance of this factor and organize an inspection bureau of its own.

266. As regards the genuineness of species, this is a matter which even trained experts cannot always guarantee by mere inspection, and only microscopic investigation can determine. The Forest Research Institute at Dehra Dun is always available and would certainly be willing to help in this respect, but time and postage rates are very often of prime importance, and facilities must be available near at hand. Dehra Dun can always be resorted to as a last expedient, but there is a vast amount of work to be done on the spot in identifying the numerous fresh species which are always coming to hand from the evergreen forests.

267. Hence, it is recommended that steps be taken to form an Inspection and Identification Bureau, working as a sub-branch of the Utilization office. Graders will be available at the Government mills as they are essential at the present time and form part of the proposed normal establishment, and these can be handed into the nucleus of an Inspection Bureau. But for the identification work, it is considered that a junior imperial officer should be specially trained at Dehra Dun for some months and then to take over the whole duties of organizing grading and inspection with headquarters, say at Coimbatore, where many samples of our timbers are available at the Forest College so that a complete identified collection of microscopic and hand samples of timbers for comparison purposes can be built up. This officer should be deputed for training as soon as possible as the preliminary work to be done is very heavy.

268. The importance of this inspection and identification branch cannot be too strongly stressed as it is a want which is badly felt and will become more and more essential as our trade tends to develop. It is proposed to organize the Grading and Identification Bureau in 1927-28.

269. *Additional Distribution or Sales Staff—*

(Under Forest Utilization Officer) required during five-year programme.

1927-28.

One Assistant Conservator for Grading and Identification Bureau will be deputed for four months training at Dehra Dun. Will then proceed with organization of Bureau, taking over graders (foresters) doing that work under Forest Utilization Officer.

One ranger }
Two foresters (graders) } for Grading Bureau.
Two clerks }

One Assistant Forest Utilization Officer (Assistant Conservator or Extra Assistant Conservator). The work of the Forest Utilization Officer will be increased owing to larger outturn from mills to be sold and new Arabian and African export trade from West Coast Re-manufacturing Export Plant to be handled.

One accountant
Two clerks } for Assistant Forest Utilization Officer.

The Forest Engineer from the Indian Forest Engineering Service already deputed to this Province will arrive in 1927-28 and take up saw mill and extraction work, where an additional man is badly needed.

1928-29.

One extra assistant conservator
One ranger
Three foresters
One clerk } for Grading Bureau.

Depot staff under Forest Utilization Officer for new depots in connection with the three new mills.

Three depot rangers.
Three clerks.
One Utilization Range Officer (a senior ranger).
Additional accountants and clerks for Forest Utilization Officer's head office.
One assistant Forest Engineer for extraction and saw mills.

1929-30.

One Assistant Forest Utilization Officer (Assistant Conservator) for veneer, plywood and tea chest sales from Papanasam.

Office staff for same, probably—
One tour clerk, one clerk and one accountant. One Utilization Range officer.

1930-31 *and* 1931-32.

No additional officers, except those in Someshwar or Amarampalam Project (same as Papanasam executive staff).

270. *Chief Forest Engineer's Office*—

With expansion of the entire Forest Engineering Branch, Government must be prepared to provide additional accountants and clerks in the head office as required in order that the whole organization may closely be supervised and efficiently administered.

H. Recapitulation of Proposed Five-year Expansion Programme.

271. This programme is presented for the general approval of Government subject to the provision that each year, before funds are actually voted, a review of what has been accomplished and revised details of proposals for the following year will be presented. As already pointed out, it may be necessary to interchange years due to circumstances outside our control. For instance, should the hydro-electric development, pulp and paper mill fail to go through as anticipated, the development of Someshwar or New Amarampalam (Nilambur) would be pushed ahead.

272. In working out this programme, cognizance has been taken of the difficulties in training staff and labour, and it is believed that expansion at the rate proposed is feasible. As more plants are added, it is of course easier to train more men for new projects.

273. A great deal of the benefit obtained by the expansion proposed is not evident in the returns anticipated during the period. It is only a beginning in the increased utilization of the forest resources of Madras—a foundation on which to build a magnificent edifice for the future. We are building for future revenues as well as immediate profits.

274. We wish to emphasis our willingness to co-operate with private interests. Wherever they display a willingness to take over any of the projects proposed in this report, the assistance and advice of the Forest Engineering Branch will be given them. We have already given sales agencies to Indian timber merchants. The African and Arabian export business is proposed to be handled through a trustworthy exporting organization. We are aiding private saw mills to establish in Government forests. We have advised private saw mills on new equipment and more efficient methods of operation. All these things are evidence of our willingness to further private endeavours in increased economic forest utilization.

275. *Cost of Five-year Programme*—

Additional equipment for present plants.

	Capital investment.
	RS.
1927–28 ...	1,72,500
1928–29 ...	38,000
1929–30 ...	39,000
Total ...	2,49,500

New plants.

	Initial capital investment.	Annual recurring expenditure.	Anticipated annual net profit.
	RS.	RS.	RS.
1928-29. Three saw mills ... Two skidders ... Quarters ...	1,45,860	2,70,440	1,68,750
1929–30. One veneer and ply plant. One saw mill ... Logging equipment ... Quarters ...	7,60,000	2,65,390	3,48,400
1930–31 and 1931–32. One veneer and ply plant. One saw mill ... Logging eqipment ... Quarters ...	9,03,000	3,22,500	3,75,000
Total ...	18,13,860	8,58,330	8,92,150

Note.—The profit shown is not all net revenue to Government as a portion of the Logging Engineer's and Utilization Officer's establishments will be chargeable against the profits of the plants. On the basis of Re. 1 an acre for mapping and cruising and Re. 1 for planning and laying out operations the logging engineering cost on the 2,000 acres felled over annually to supply the new plants would be Rs. 4,000. No data is available from which to accurately determine the cost of marketing by the Forest Utilization office, but it should not exceed one anna a cubic foot, or say, Rs. 36,000 annually. This leaves a net annual revenue from the new plants proposed of Rs. 8·5 lakhs.

Of course funds to regenerate the areas cut over will have to be added to the district forest budgets. On the basis of a maximum of Rs. 40 per acre, regenerating 2,000 acres annually would cost Rs. 80,000. However according to the modern view of forestry, the cost of regenerating a forest is charged against the future crop. Therefore no deduction on account of regeneration is made from anticipated profits.

I. Forecast of the Future.

276. What of the future after 1932? It is believed that further development will be along the lines of increased participation of private enterprise and investment of private capital in forest utilization enterprises. It is even quite possible that some of the new projects proposed in the five-year programme may be initiated by private interests. Different groups have already expressed their interest in Someshwar Exploitation Project, the West Coast Export Re-manufacturing plant, and in the Papanasam Forest Industries Centre. With Government pioneering the way, wood using industries will continue to expand until the maximum potentialities of the forest are reached, and the annual growth (volume increment) balanced by the annual cut. Then will Madras be independent of foreign wood supplies and the Rs. 99 lakhs now being paid out to other countries for timber imported will be distributed in the Presidency in the form of labour pay-rolls, interest on local capital invested, and revenue to the Government. The surplus of production over local consumption will be exported and bring further wealth into the country.

Increased participation of private enterprise.

Imports replaced by Home production.

277. With a greater forest crop to harvest and larger areas to regenerate the Madras Forest Department will increase in size and importance. The Forest Engineering and Utilization Branch of the department will cease to be a quasi-commercial concern, but will be Government's direct representative in dealing with the private concerns operating on or being supplied by Government forests.*

Future activities of Forest Engineering Branch.

278. Timber sale contracts, concessions, log scaling, grading, inspection and supervision of private operations will be new activities of the Forest Engineering Branch of the future. Logging Engineers, as liaison officers between exploitation on the one hand and regeneration on the other, will continue to be essential. The present work in utilization and research, developing new uses for woods and new markets, establishing uniformity in grades and guaranteed species, will be expanded. Opening up hitherto inaccessible forest tracts will necessitate the construction of new roads and buildings, making further demands upon the Forest Engineering Branch.

279. With regard to the Forest Engineering and Utilization Branch of the future it is well to sound a note of warning against ever putting at its head a man who has had no technical training and practical experience in forest exploitation and utilization. Problems constantly arise which require sound technical knowledge on the part of the administrative head for their solution. He must have the strong foundation of practical experience in the varying activities of the branch, or the efforts of the officers under him will be nullified, and the branch fail to function efficiently

280. This development of the utilization of the forest resources of Madras is an ambitious programme, but a practicable one. We have the raw material, we have an ample labour supply, and a nucleus of trained men, and we have the markets for the finished product—all in ample quantity. Given men of vision, men of energy, men who have the will to push a problem through to its successful solution, men who will give their whole-hearted support and wise counsel refraining from uniformed criticism and obstructionism, and every expectation advanced in this report can be realized.

J. Value of Reports in Appendix.

281. The attention of the reader is particularly invited to the reports given in the appendix. The report on the veneer industry by Mr. Wernham was written during his deputation to the United States of America and gives a comprehensive description of the methods of making veneers. The possibilities of the veneer industry in connection with Madras forest development are lucidly presented.

282. The Philippines report shows what has been accomplished in forest exploitation under conditions quite similar to those in Madras, and contains many useful suggestions.

283. The Sappal Valley map is included to show how operation planning is done, and how the large scale maps and accurate enumerations made by the Logging Engineering division of areas to be exploited are used in controlling extraction as it progresses. Facts replace guess-work in modern logging engineering.

284. The scope of the Forest Economist's work is indicated by the list of subject ledger files. The lists of woods being tested by private firms and by Dehra Dun show the possibilities for extending the uses of Madras timbers.

* In this connexion attention is invited to the report on "Forest Exploitation in the Philippine Islands" in the appendix of this report, which illustrates the lines on which the control of private lumbering operations by Government may well follow.

APPENDIX A

THE VENEER INDUSTRY

AND ITS RELATION TO THE PROFITABLE UTILIZATION OF

SOUTH INDIAN HARDWOODS

BY

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MADRAS

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Suggested treatments for certain Indian hardwoods in their conversion into the veneers—

Laurel wood.
Rose wood.
Satin wood.
Tulip wood.
Other South Indian woods.

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PREFACE

The following note was recently submitted to the Faculty of the University of Washington, United States of America, and the subject was chosen as being one which might be of interest to all those who are in any way connected with the hardwood industry and especially those leaders of the big manufacturing concerns who are seeking to obtain their future supplies of high class and ornamental woods from tropical countries.

Throughout his tour around the world the writer was greatly impressed by the interest which is being taken in the so-called shortage of hardwoods in the big consuming and manufacturing centres.

England with its ports of Liverpool and London can still be considered the centre of the high class hardwood trade, and through these channels the supplies, which come almost entirely from overseas, are distributed mainly to Europe and to America.

That the supplies of high grade hardwoods are restricted may be gathered from the prices which these woods obtain, when it is realised that the cheapest cabinet hardwoods obtainable in large quantities in the English market come all the way from Japan (Oak), the Philippines (Mahogany), South America and West Africa. Teak, of course, is obtained from the East Indies, together with certain other species in small quantities, such as rose wood and satin wood. Australia, also, is now developing an export trade. The enormous potentialities in forest wealth which the British Empire possesses were well illustrated at the British Empire Exhibition in 1924 and 1925, although many developments must take place at the origin of supply before this great wealth can be properly exploited and used.

The United States of America is probably one of the greatest consumers of hardwoods in the world and the concern with which this country views the hardwood shortage may be gathered from the fact that she has just deputed Professor Record of Yale University, her greatest expert on tropical hardwoods, for a tour through South America to investigate the possibilities of the untold wealth lying tied up in the forest growth of the Amazon Valley and the surrounding country.

This world famine in hardwoods must affect all those who are interested in the possibilities of the forests in South India.

The majority of countries are now recovering from the effects of the Great War and all over the world, there are signs of large works of reconstruction and development being carried out.

Thus the demand for hardwoods is bound to increase especially for high class and ornamental kinds.

South India is a country containing vast supplies of such woods, the majority of which are as yet unknown to the outside world.

The exploitation of these forests, the economic utilization of the species, and the development of markets, are now engaging the attention of the Government of the Madras Presidency, and this work suggests *one* means of opening up the huge potential resources which the Presidency contains.

The opinions expressed and the data offered are the result of three years' experience in South India and a two years' tour through England and the United States of America.

It is desired to express the thanks of the writer to all those who have so kindly helped him with information, especially the Faculty of the University of Washington, Seattle, United States of America and the Staff of the United States Forest Products Laboratory at Madison, Wisconsin. Also to those firms who have facilitated his visits to, and inspections of, their plants, especially Messrs. I. T. Williams & Co., New York, W. T. Marshall Company, New York, the Wood *Mosaic* Company of Louisville, Mengel & Co., Louisville, Ohio Veneer Company, Cincinnatti, Mikey & Co., Memphis, Louisville, Veneer Company, Louisville, Mutual Veeneer Company, Grand Rapids, Willey Brothers of Chicago, the Grand Rapids Veneer Company of Grand Rapids, and the New Albany Veneer Company of New Albany.

Madras, July 1926. J. W. K. WERNHAM.

PART I.

The Forest Resources of South India and the Possibility of Economic Markets and Utilization.

CHAPTER I.—INTRODUCTION.

The Government forests of British South India are situated in the provinces of Madras and Coorg and comprise some 25,000 square miles. The whole of this area is not covered with remunerative forest growth, as certain lands are maintained solely for protective purposes, and in other cases, as grazing grounds for the cattle of the local inhabitants.

There are, however, tracts of forests containing very fine stands of timber and these are found in the western districts where the rainfall is heaviest, especially in the hills running parallel to, and about 75 miles from the West Coast. The districts concerned are those of North and South Kanara, Wynad, Malabar, the Nilgiris, South Coimbatore and Tinnevelly, and they contain forests which in many cases have never yet been exploited or even cruised, and of which little is known.

These productive forests may be classified as "Deciduous" and "Evergreen" and are formed entirely of hardwoods or broad-leaved species, there being no natural stands of conifers in South India.

The deciduous forests are found on the plains or localities below approximately 2,000 feet elevation, and are thus comparatively easy of access and exploitation. They are characterised by such species at teak, rosewood, laurel wood, the false walnuts and the iron wood, with a liberal mixture of soft hardwoods such as the Bombax which corresponds to the cotton wood of America, and certain medium species such as Adina cordifolia and Stephegine parviflora corresponding to the gum wood of America or the beech of Europe.

Many of such species are white-ant proof and this fact, coupled with their easy extraction, has resulted in their exploitation for ages past, and it is therefore not surprising to find that many of the more beautiful and useful woods, such as the rosewood and teak, have found their way, through traders, to all parts of the world.

The evergreen forests are found in the hills usually over the 2,000 feet elevation line, where the humidity conditions are always high and the rainfall heavy—sometimes over 200 inches per annum. The configuration of the ground is often very rocky and precipitous, and extraction is therefore difficult. The species found are extremely numerous and mixed, and the trees of the more common of them are of large girth and clean bole. The woods, however, have a high moisture content and many contain injurious saps. If cut and left to season on the spot, the damp humid conditions often cause rapid deterioration through fungi attacks, while if the logs are brought to the plains, the change of conditions from the damp cool forest to the dry tropical heat causes checking, splitting and warping.

Thus it is not to be wondered at that the evergreen forests have remained almost intact, and the species commercially unknown, while the native inhabitant has found a sufficiency of supplies to meet his small demands from the deciduous forests of the plains.

Altogether, South India can boast of about 2,500 different species of hardwoods to be found in its forests. It is the deciduous class, having annual rings, which provide the so-called cabinet or furniture woods of commerce, the requisites for which are colour, grain, and durability, although having these qualifications, does not detract from their natural suitability for constructional purposes. The stands are not as dense or as heavy as those of the evergreen forests where the majority of species have woods of more regular colouring, and having no annual rings, do not possess figuring. Such woods, however, if properly extracted, quickly converted, and carefully seasoned, are exceptionally fine and provide excellent material for constructional purposes, inferior trim, core stock, ply wood and boxes.

Summing up, therefore, the woods of South India may be divided into five main groups :—

(1) Ornamental for furniture, works of art, etc.

(2) Interior trim for shop fittings.

(3) Constructional for buildings, railway ties, etc.

(4) General utility for boxes, crates, core stock, plywood, furniture backing and drawer bottoms.

(5) Specialised such as ebony, box wood, iron wood, etc.

It is with this classification that the possible markets for the woods will be considered and the most economic utilization discussed.

CHAPTER II.—INVESTIGATION OF MARKETS.

In investigating the possible markets for South Indian timbers, it would be best, first of all to consider the condition and trend of the general timber situation.

The timbers of the world are divided into two main classes—hardwoods and softwoods—or broad-leaved species and conifers.

The hardwoods, as a class, are regarded as heavy, durable, strong, hard, and more variable as regards grain, colour, and texture. They are thus suited for ornamental work and for purposes where rough usage may be expected and lasting qualities required. The greater proportion of the quantity of hardwood cut is factory manufactured and in 1923 in the United States, 80 per cent of the total hardwood crop was dealt with in this way. This figure was four to five times as great as that of softwoods factory manufactured.

The softwoods as a class, are regarded as fairly light, not as strong as hardwoods but tough, giving greater strength for weight, easy to work, more general in colour and texture, and more consistent in quality. They are thus suited for constructional purposes, sashes and doors and general utility purposes.

But, in considering the conditions in any country, it is only natural to conclude that that country will utilize those species which it produces locally for all possible purposes and will refrain, as far as possible, from importing from outside sources, even although the outside product is more fitted for any set purpose. This, however, is governed largely by the question of prices and the facility in obtaining supplies. For instance, in America in many of the Eastern States in which hardwoods predominate, this class of material is used for constructional purposes, ornamental work, interior trim, railway ties, and even packing cases, while in the Western States where softwoods form the large stands of timber, all those utilities are served by the softwood class.

If a country has no real available local supplies at all, it will import those classes most suitable for its needs—hardwoods for ornamental purposes and interior trim, softwoods for constructional and general utility purposes—unless of course prices, made prohibitive by excessive freight rates, demand otherwise.

Examples of both cases may be quoted. Great Britian has no real forests of its own and is forced to import all of its wood. Hardwoods, such as oaks, are imported from Austria, America and Japan, beech from France, mahoganies from British Honduras and West Africa, teak from Burma, rosewood from the East Indies, and many tropical species from India, Africa, Australia, and South America. Its softwoods it imports from Canada, America, Sweden and formerly from Russia.

On the other hand, Mesopotamia has hardly any tree growth at all; all its timber requirements are to be met from outside sources. Its fuel comes mainly from Karachi, North India and Persia. All its other demands are met from the hardwood forests of the Indian Peninsula, Burma and the Andamans; softwoods from other countries have not yet been able to compete owing to the excessive freight rates.

Markets automatically divide themselves into two groups—home and over-seas.

Home Markets.

India as a per capita wood consuming country must rank very low in the scale of the nations of the world, owing mainly to the small demand necessitated by the climate and social conditions and the customs of the country. In the past the main demand for wood has been for agricultural implements and for fuel, but with the inroads of Western civilization bringing with it railroads, industries and fine modern buildings, large quantities of timber are now required. For the past few years South India has not kept pace in forest exploitation and utilization with its ever-growing demands. Examples of this may be obtained from the following facts. In 1923, over 60 per cent of the South Indian Railway's requirements of ties were imported from outside sources, mainly from Australia, Canada and America. In the same year and in 1924, the majority of constructional timber and material for interior finish in all the new business houses in Madras City were from the Andaman Islands or from Burma.

All the ply wood tea chests used by the tea planters of South India are made of Swedish wood obtained through London. This case is one of particular note as the planters in clearing the land for their plantations are cutting and burning fine tracts of evergreen forests which contain species eminently suited for the manufacture of ply wood equal in all respects to that imported.

In 1924, every machine-made tool handle used by the railway workshops, corporations and commercial concerns, was of foreign manufacture, although there are hundreds of square miles of forests producing a species which has been declared by the Research Laboratories at Dehra Dun, North India, to be equal if not superior to English ash or American hickory for this purpose.

These are only a few of the markets which exist *now* and which, with the employment of organised logging and the installation of a few simple mills and plants, could be captured without any real effort.

To ensure success in this respect, much could be done by close co-operation with the railways. Freight zones, special timber rates, making up full-car loads, etc., are points at which to aim and on which satisfactory agreements can be reached.

The salient factor, however, on which success depends more than any others is that the materials of which it is desired to dispose must be put on the market in that state in which they are required by the consumer and of such a grade as can favourably compare with that of any foreign imported goods of the same class.

Overseas Markets.

South India at the present time may be said to have no timber-exporting trade. It is true that such species as its teak, rosewood, and ebony find their way all over the world but the quantities are very small. It is only in the last year or two that sample consignments of logs of some of its many woods have been sent to the London market as experimental parcels. The deterrent factors which confront such a proposition may be summed up as follows:—

(1) Excessive freight rates.

(2) Various requirements of the different foreign markets.

(3) The gambling or unknown element in the purchase of logs as such logs may prove after purchase to be sound or unsound, figured or plain.

(4) The customary long periods between the shipment of logs in India and their disposal in a foreign market with the consequent large percentage of wastage caused through deterioration of the logs owing to decay, discoloration, checking, and splitting, together with excessive storage rates.

(5) Open competition with so many other hardwood producing countries having large and up-to-date saw mill and remanufacturing equipment.

Of these, No. (2) naturally is the most important as it is no good even considering the exportation of material and the freight rates thereon if for such material there is no possibility of obtaining a market.

A consideration of the possible foreign markets for South Indian timbers would appear to be advisable and in this respect investigations have been carried out in the two countries offering the greatest promise—England and the United States.

The English Market.

Great Britain is unfortunate in possessing no real forests of commercial importance—either hardwoods or softwoods—and therefore imports all of her heavy requirements. The other European countries, together with Canada and America, supply her with softwoods and commercial hardwoods, so that South India can expect to compete only in respect of the latter.

With this end in view, the Madras Presidency has for the past three or four years shipped certain of her woods to London for sale under an agency mode of disposal. Owing to the lack of saw mills in South India itself, all such shipments have been in the form of round logs or rough squared logs, and although all the conflicting factors as enumerated in the preceding section have been present and comparative financial losses incurred, this method of procedure was necessary to test out the market to ascertain—

(1) Sale prices and expenditure.

(2) The demand for certain species.

(3) The utility of certain species.

A survey of the results under the present conditions above shows that—

(1) With the high freight rates, handling charges, and storage fees, it pays to export only selected and high class material fetching fancy or specialized prices.

(2) The species most in demand are those of a specialized nature with peculiar characteristics, such as having figure, special grain, or coloring. Final effect is more important than the ease of conversion, treatment, or working.

(3) All such woods are in demand for cabinet work and interior finish. Figured stock is cut into *veneers* and the plain into boards and dimension stock for furniture and trim.

It may be said that practically all the hardwood imported into the United Kingdom is remanufactured in factories where the greater proportion is cut down to small sizes for general utility. In the furniture trade there is a widespread demand for solid wood manufactured articles and parts, except of course for the panels, which are almost always of veneer. This contrasts very markedly with the conditions in the United States of America where the present demand and practice is almost universally for built-up veneer covered parts.

Owing to the lack of enthusiasm in the development of the dry kiln practice for treating hardwoods and the preference for air-dried stock, there have been considerable delays in the placing of the South Indian material on the market, its subsequent absorption, and its final utilization with appreciable losses in deterioration and added expense in the matter of tied up capital.

The only woods which have received any favourable demand are those which are already well known, or which have, through the more rapid conversion and utilization into *veneers*, impressed themselves on the public eye through the medium of expositions and show rooms.

The American Market.

The United States of America as a whole has been, until recent years, in the enviable circumstances of being able to supply most of its own domestic requirements of wood, and has in fact been an exporting country both in hardwoods and softwoods.

As regards the latter, it may be said that it still fulfils this capacity, but in the matter of hardwoods, its imports are increasing year by year.

An investigation of the American situation will reveal at once the presence of two distinct markets—the Eastern and the Western—separated by the desert mountain regions of the Rockies which fact makes freight rates between the two extremely high and greatly impedes trade.

The increase of the imports in the East may be attributed to two main reasons —firstly, the cutting out of its hardwood forests which were the only existing supplies in the country, and secondly, the natural desire of the people for variation and exclusiveness. Hardwoods have thus become comparatively so expensive that the only uses to which they may be put are for decorative works, either in the form of furniture or interior trim. The automobile industry formerly consumed large quantities, but in this respect metal has now almost superseded wood in the cheaper and greater proportion of cars.

Thus, the growing scarcity and the increasing cost of home-grown supplies, together with a steadily growing demand, have naturally encouraged the importation of hardwoods from other countries. Formerly, such woods were confined to the mahoganies and the rosewoods, but in later years the improvements in glues, the more elaborate machinery, the development of industry and the close utilization of material in the form of veneers and laminated stock have resulted in a steady demand for many other decorative species from South America, India, the Philippines and Australia.

New Orleans, New York and Boston are the chief importing centres for the Eastern States and act as centres of distribution to the big industrial concerns.

In the West, on the Pacific Coast, the position is slightly different, as there are no natural stands of hardwoods. The abundant supplies of softwoods have been made to fulfil all purposes and this has sufficed in a land in the process of being settled and developed where results are more to be desired than effect. Where hardwood furniture and fittings were required, they were imported from the Eastern States at high cost.

In the last few years, conditions have changed. With the miraculous growth of many large cities, the erection of fine permanent buildings, the increasing population and the multiplication of industries, hardwoods are being demanded for their rightful purposes, and we find tropical timbers being imported from Japan, the Philippines, and South America, through the ports of Seattle, San Francisco and Los Angeles.

As a whole, the tendency of the United States in the utilization and the remanufacturing of hardwoods is away from the solid and towards the built-up stock, for all kinds of furniture and panelling, and in many cases for interior finish.

With the exception of that from the Philippines and perhaps a little from Japan, all imported material comes in in the form of logs of which those with suitable colour, figure and texture are cut into *veneers*, and the remainder into stock thicknesses. A striking feature of this utilization of tropical hardwoods is the fact that, with the exception perhaps of a small number of panel plants, very few of the factories turning out the finished article of furniture or interior trim cut their own *veneers*. This is carried out by concerns specializing in this work and the cutting is generally executed to order, or sales are effected from stock.

CHAPTER III.—THE DEVELOPMENT OF MARKETS.

If the situation is as is described in the foregoing chapters, it would appear that there are, without doubt, real and potential markets for South Indian hardwoods both in India itself and in other countries—they only require developing. As to how this may best be effected, it would be well to study the lines along which other parts of India and other countries with similar problems have progressed in this respect.

Burma has built up a considerable reputation and trade mainly on teak. At first logs and squares only were exported and then the trading concerns which entered the field started to put in mills to meet the demands of foreign markets. Its other timbers, such as padouk, silver-grey wood, Burmese mahogany, etc., are now receiving consideration, all of which it is exporting chiefly to the British market in the form of converted material. It has lately been successful in almost monopolizing the Mesopotamian market for sawn timber.

The Andaman Islands lumber trade has grown to an amazing extent, but its greatest strides have been made since the installation of a very fine saw mill. Many of its species hitherto unknown are now capturing numerous markets, especially those of London, Calcutta and even the Eastern Madras Presidency, where the clean machine-sawn product is ousting the hand-sawn or log material.

Australia has gone ahead and has many private concerns with up-to-date mills. Its mill-sawn ties have been recently imported into Madras for the South Indian Railways. It has its own veneer mills and is producing its own ply wood for domestic use.

West Africa and British Honduras are perhaps exceptions to the general rule as they have built up large exporting businesses and up till now have hardly any big mills, but their trade is a question of "greatness thrust upon them" in that they are both fortunate in producing large natural supplies of mahogany—a wood of peculiar suitability and adaptability, old in reputation and greatly in demand.

Japan has a fairly large export trade in hardwoods, it imports softwoods. The sawn Japanese oak is well known in England and the United States.

It is perhaps from the Philippines that the greatest object lesson can be taken. Here is a group of islands containing magnificent tropical forests, and, with conditions very much the same as those in South India, unknown ecies, all hardwoods—no large local demands—a remarkable timber trade is being built up. Commercial enterprise has been responsible for the development by employing the most up-to-date American logging practices and installing a series of saw mills and plants. Almost the whole export trade is in the form of sawn lumber, veneers and panel stock, the mills being all situated as near as possible to the logging operations. The veneer plants use the rotary, slicing, and sawing methods and make up panel stock, so utilizing their more common species for cores and their ornamental timbers for faces. The last five years has been a remarkable increase in their production figures, caused mainly by developing the markets on the North American Pacific Coast.

The outstanding feature of these examples is the large part played by the installation of saw mills and conversion plants at the source of production. Similar installations in South India would solve or minimise many of the confronting problems to be met with in the building up of an export trade.

The excessive freight charges per unit of finished material would be reduced as only that quantity would be shipped as can be sold and fully utilized at the purchasing end. The conversion of the raw stock should be carried as far as possible in South India to that stage at which it is required for actual manufacture, that is, in planks and *veneers*. The freight on wastage in conversion and deterioration in log is eliminated. It is realised that freight rates on converted material are generally higher than on logs, but the long distance carried, and the excessive handling and storage rates will automatically prove in favour of converted material.

The requirements of the most favourable foreign markets have been outlined in the preceding chapters.

The English market requires material to be cut before final utilization into *veneers* and also a certain amount of sawn stock of various sizes in not over 2 inches thicknesses.

The American market requires material almost exclusively for *veneers*. A certain amount of sawn stock of various sizes, not over 2 inches thicknesses, will be required as the species introduced become known and adapt themselves to special uses as for interior trim and furniture.

Conversion of stock in India would eliminate the gambling and uncertain element in the present system of purchasing the material in log and which tends to reduce the prices offered for genuine and suitable material. The prior conversion before exportation would ensure the prior knowledge of material to be advertised and sold, and would thus facilitate the making of more correct estimates of the values of cargoes despatched.

The usual delays in the disposal of a log between the time of its arrival in the foreign market and its disposal and final utilization is the result mainly of the unknown quality of the wood. There are many buyers who would purchase if they knew its figure and colour, its ultimate outturn in sawn and seasoned material, and if it were in a seasoned state ready for immediate use. The majority of dealers

cannot afford to gamble on the inside of a high class log, to pay for conversion, and then to tie up the invested money for one or two years while the material air-seasons.

A more ready sale and also larger sales could be effected if the material were placed on the market converted and seasoned to the air-dry state. The sawn material could be inspected and sold under definite grades, whilst *veneer* stock could be sold by sample.

Moreover, the storage charges would be very much reduced per cubic foot of finished material than in the case of exporting only logs, as in the latter storage has to be paid on that portion wasted in conversion or lost by deterioration, whilst in the former all the material charged for is utilized.

The quicker sales also reduce the length of time for which storage charges are liable.

The competition of other exporting countries is only natural but it can be met successfully by installing in South India plants with up-to-date machinery and expert supervision. Raw material is cheap, fuel for power is abundant, common labour is plentiful, and plant sites and storage location easily available. Thus, prices should be comparatively low, but, although price is a very dominant feature in developing a market, yet in the case of those species which are suited or in demand for some special purpose such as for furniture and interior finish, the beauty of the wood counts even more, and competition may be expected only from concerns dealing in the same species. As the majority of the species to be introduced are common to South India alone, no foreign competition is to be expected and, providing price is satisfactory the species must stand or fall by their merits.

CHAPTER IV.—CONCLUSIONS.

From the foregoing chapters there would seem to be no hesitation in stating that the *veneer industry* is destined to play a very large part in the profitable utilization of South Indian hardwoods. It is not safe to say the "major" part as, owing to the non-existence of natural stands of softwoods, the hardwoods will have to take their place and be used for railway ties, constructional timbers and general utility purposes. It must be allowed that in the meeting of these requirements the forests will prove their greatest value and justify development.

However, it has been shown that there is an ever-growing scarcity of supplies to meet an ever-increasing demand for hardwoods in the largest world markets of America and England and it is to the untouched tropical resources of the world that attention is now being directed. South India has such forests containing timbers eminently suited and highly prized for the purposes required.

It has also been shown that nearly all the hardwoods imported by these two great markets are cut into veneers and that the industry is growing in importance very rapidly. The whole hardwood trade and allied industries seem controlled by veneers and built-up construction.

Finally, it has been shown the cutting of the veneers in South India for export to these markets is the most logical trend of development. If plants were installed and cutting commenced, there are certain species of wood already well known and the disposal of the product should be assured. For the introduction of new species of ornamental woods for which such great opportunities present themselves, no better way than by veneers could be utilized as the saleable product can be seen by the prospective purchasers in the finished state; it can be used without the delay necessary for long air seasoning as would be the case with log or lumber; storage rates in the foreign country are eliminated as it is sold by sample, and contracts and dealings can be made for small quantities.

Not only in the utilization of the valuable ornamental species and development of foreign markets is the veneer industry to play its part, but also in the development of the Home markets. The great ply wood tea box industry, ply wood seating construction, and numerous other opportunities are awaiting the installation of veneer plants to utilize the many suitable species.

As the introduction of the veneer cutting industry in South India appears to be so imperative to the full utilization of its wonderful resources, an endeavour will be made in the following chapters to give an account of the industry itself.

PART II.

The Manufacture of Veneers.

CHAPTER I.—INTRODUCTION.

Veneers are thin slices or sheets of wood so cut with a view to applying them to themselves or to thicker pieces of wood by the use of glues, for their final utilization, and even in certain cases of being used alone where thin material is required.

The practice of using wood in veneer form has been customary for a very long time and records show that the Egyptians practised the art of cutting and applying veneers more than 3,000 years ago. There is nothing on record to show how these veneers were cut and, in all probability, they were obtained by splitting, planing and abrasion.

The veneer industry proper may be said to have started in England in the early nineteenth century, when a power-driven circular saw was patented and put into use for the sawing of veneers. A little later on, a machine for slicing veneers was put on the market and this was the forerunner of the present-day rotary lathe and slicing machine.

At that time, however, the industry was still in the stage of being an art, as the only veneers cut were made from beautifully grained and handsomely figured woods which, owing to their extreme cost, were seldom used in the form of solid material. Such veneers were employed in the manufacture of furniture and decorative articles.

This state of affairs continued until 30 or 40 years ago when fashion, necessity and opportunity combined to give an impetus to the industry. A demand grew for a change from the old solid type of furniture to something more delicate and ornamental. In the manufacturing countries the growth of the other wood-using industries began to make inroads on the home-grown supplies of reasonably cheap cabinet woods, and the depletion of these natural stocks, especially of the more valuable species, caused a rise in values and a consequent more exacting form of utilization. Thus, the tendency was to manufacture high-class furniture and fittings with a face of highly priced veneer, with the centres or cores made from the mediocre or low class stock.

Fortunately, at that time exploration and development of many foreign lands were being carried out, and this made possible the obtaining and the introduction of many beautiful tropical timbers.

The development of the industry brought innovations and improvements in the method of cutting, and one result has been to give us the present-day rotary lathe by which approximately 85 per cent. of the veneers cut in the United States are now manufactured, and which has made the industry one of the foremost wood users in the world.

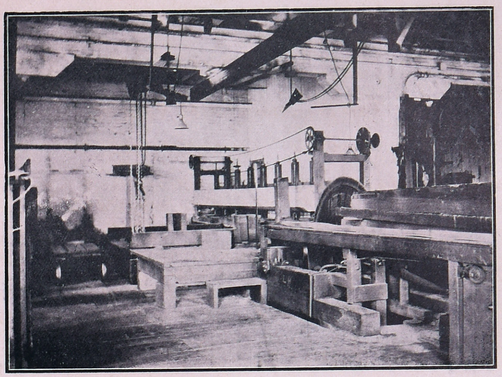
CHAPTER II.—THE METHODS OF THE MANUFACTURE OF VENEERS.

There are three methods of manufacturing veneers—

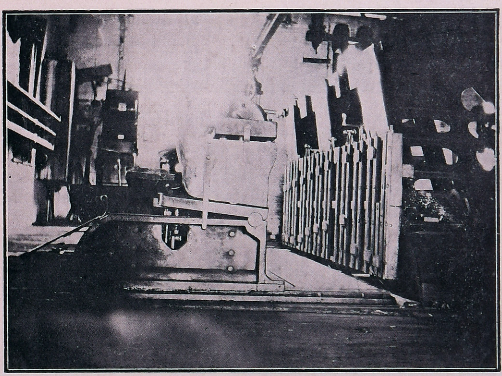
(1) By sawing.
(2) By slicing.
(3) By rotary cutting.

(1) Sawing.

The first sawn veneers were cut by hand and naturally the process was slow and expensive. With the introduction of a mechanically driven circular saw, a new phase was entered which has seen the development of the industry, and the present-day veneer saw is a much elaborated machine.



1. *SAWING VENEERS.* NOTE THE FLITCH HELD BY THE SCREW DOGS. THE CUT VENEERS ARE BEING PILED ON THE TABLE IN THE NEAR FOREGROUND.



2. *THE SLICING MACHINE* SHOWING THE ARRANGEMENT OF THE SCREW DOGS FOR HOLDING THE FLITCH ON TO THE STAY LOG. THE STAY LOG IS GIVEN AN OBLIQUE UP AND DOWN MOTION BY MEANS OF THE OBLIQUE SLIDES SHOWN. THE KNIFE IS HELD BY THAT PORTION OF THE MACHINE SHOWN IN THE CENTRE OF THE PICTURE.

The blade of the veneer saw is made up of segments which are affixed to the circumference of a central disc. The segmental form has been found to be the most practical one for repair and replacement. The disc is thick in the centre and has a gradual taper outwards, which makes for strength, rigidity and uniform thin cutting. The saw segments are comparatively small and thin and usually make a kerf about 1/20 of an inch thick. A blade of this kind can be built up to large sizes—to as much as 6 to 8 feet in diameter—although 4 to 6 feet is the common dimension.

The wood to be converted is delivered to the machine in the form of "flitches", which are heavy slabs so cut out from the log as to bring out the desired figure or grain in the finished veneer.

The flitches are fastened to a steel "stay-log" by screw-dogs and the stay-log is mounted on a vertical saw carriage which is power driven backwards and forwards. In all the up-to-date machines, the feed is automatic, the carriage being set up nearer the saw after each cut to correspond with the desired thickness of veneer.

The cut veneer is drawn away from the saw by a stationary bevel block with a vertical edge. It falls face downwards on the platform and, as one sheet succeeds the other, the whole is automatically stacked with the material in the same relative position as it was in the uncut flitch.

The bundle so formed is retained intact for final utilization or sale, as such a practice facilitates the matching up of several pieces of veneer in the design making of ornamental panels and also provides the greatest quantity of similar grained and coloured material for the carrying out of any work entailing the use of such characteristics.

The sawing process, though simple, is very wasteful of material on account of the relatively large saw-kerf, and is therefore expensive. The usual thickness for cutting such veneers is 1/20 of an inch, and so with a 1/20 of an inch kerf and a further wastage represented by the portion of the flitch which is actually held by the screw-dogs and which therefore cannot be cut, less than half the original flitch is present in the sawn product.

In spite of this drawback, the sawing process is widely practised. It produces the most desirable veneers of any of the three methods, as the fibres of the wood on the surface are not separated by the crushing effect of the knives used in the slicing and rotary processes. Both faces display good quality and appearance and therefore enable the veneer sheet to be used in the matching of face stock for figure and design in the manufacture of ornamental panels.

Thus, it is found to be the most suitable process for the conversion of high grade finish and furniture hardwoods and brings higher prices than that obtained from the slicing or rotary cutting method as turning out a product which is stronger and less likely to induce defects which may show up after the finished surface has been in use for some time.

(2) Slicing.

The principle of the manufacture of veneers by the slicing method is identical with that of taking a shaving off a piece of wood with a carpenter's plane. Several types of veneer slicing machines are in use, but the principle of operation in all is practically the same in that the slicing knife is stationary and the flitch is moved against the knife by power.

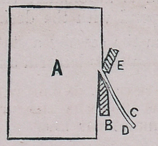
As in the sawing method, the material to be sliced is prepared in the form of a flitch and this is bolted or dogged to a heavy steel stay-log by means of screw-dogs placed at intervals of about one foot. The dogs hold the flitch in place both at the top and bottom and keep it firm. The stay-log is given an oblique up and down motion either by means of slides or by eccentric rods. On each down stroke the flitch is drawn against the edge of a stationary knife which is held rigid by a heavy steel pressure bar, and a slice of veneer is thus cut off. On the up motion the knife automatically recedes by means of a rocker arm, so that there is no interference with the flitch. After the flitch has passed it, the knife returns to its cutting position, the whole carriage carrying the knife automatically advances the required thickness of the veneer and is ready for the next cut.

As each slice is cut, it falls through the knife slot on to a platform and is turned over by hand, each successive slice being piled in order, thus keeping them in the same relative position as in the solid flitch.

As with sawn veneers, these piles are usually kept and sold in tact, as the veneers are used mainly for face stock, and matching for panels is thus facilitated.

By the slicing process much greater economical utilization is obtained than by the sawing process, as the kerf wastage is eliminated. A further advantage is that thinner veneers can be cut—sheets as thin as 125 to the inch have been made—but, on the other hand, such veneers have only one face owing to the action of the knife in cutting and the consequent checking of the surface. This causes what are termed "open" and "closed" faces, the open face being that which is nearer the knife as the veneer leaves the machine.

Diagram showing the action of slicing.



A=Flitch.
B=Knife.
C=Closed face.
D=Open face.
E=Pressure bar.

The open face cannot be finished well, and for this reason the veneer is not reversible to obtain the most satisfactory results in the matching for panels.

The thickest veneers cut by this method are about 1/16 inch, so that relatively thin dimensions only can be obtained, the more common being 1/28 inch in America and 1/50 inch in Europe. Subsequent handling of these veneers thus calls for special glues and care in working and the method should be employed only in the case where extreme economy is desired when cutting very valuable material.

(3) The Rotary Process.

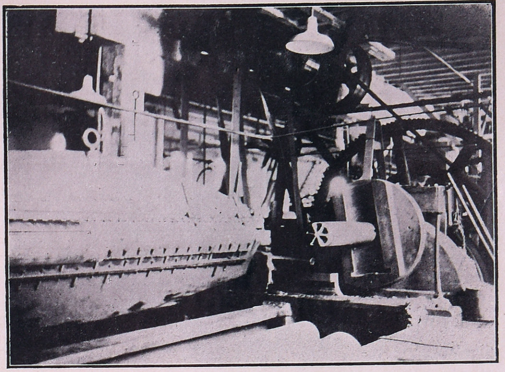
This process, although the latest to be evolved, is by far the most common now employed in the veneer industry, and is responsible for cutting between 70 and 80 per cent of the total veneer manufactured. Its evolution and development has taken place in the last 30 to 40 years to a remarkable degree.

The main piece of machinery used is the rotary lathe, the general plan of all machines being the same. The typical lathe consists of a heavy steel bed on which is mounted at each end a framework for the support of the bearing shafts. The shafts are equipped with chucks for gripping the log and can be shortened or lengthened as necessary.

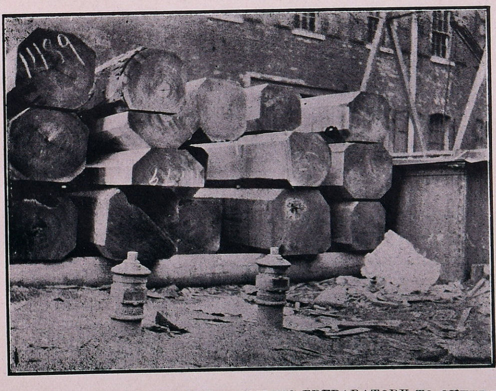
The logs, which have previously been cut into suitable lengths by cross-cut saws in the mill yard, are brought into the mill, hoisted by power, and inserted in the lathe. The chucks are driven inwards by power to grip the log firmly.

The knife extends the full length of the machine on the inside of the frame, and is regulated to even cutting by a pressure bar. This pressure bar and its regulation are perhaps the most important essentials in the production of veneer. It is usually made of reinforced steel and runs the length of the machine just above the knife so that the wood, when being cut, is always being forced against it. This has the effect of compressing the wood at the cutting surface and obtaining a clean cut rather than a split or tear as is liable to be the case if the wood is brittle, or the knife dull or thick bodied in size.

The latest patented invention as regards pressure bar development is to construct the bar in the form of a roller. The roller, about 5/8 to 7/8 inch in diameter, is of high grade steel, and so mounted and controlled by gears connected to the rotary lathe, as to rotate at the same speed as that at which the veneer is being fed off the machine. The bar is reinforced or strengthened by means of bronze bearing plates which extend from a massive rigid frame and which take the thrust exerted by the wood on the bar. This invention is calculated to eliminate the roughing effect caused by the rubbing of the softened surface of the log on to the stationary bar, and also ensures smoother running in cases where radial splits and checks occur in the log.



3. *THE ROTARY MACHINE* OR LATHE, ILLUSTRATING ONE OF THE TWO CHUCKS FOR HOLDING THE LOG. THE HORIZONTAL KNIFE IS SHOWN IN THE CENTRE OF THE MASSIVE FRAMEWORK TO THE LEFT.



4. *WALNUT LOGS READY FOR STEAMING FOR BOILING* PREPARATORY TO CUTTING ON THE ROTARY MACHINE. THE PILE ALSO CONTAINS TWO FLITCHES FOR SLICING.

The actual cutting is accomplished by revolving the log against the knife, the veneer being peeled off in a continuous sheet. The knife is fed slowly by geared arrangements towards the log as the cutting continues, the rate determining the thickness of the veneer.

As the veneer comes from the lathe, it is received on a table or carrier, torn or clipped into convenient lengths for handling, and later clipped again to eliminate defects and to bring the sheets to the desired dimension.

Rotary cut veneer has an open and closed face to an even more marked degree than sliced veneer, as the open face caused by the cutting action of the knife is pressed out flat, whereas in the log it was in a circular plane. This checking can, however, be greatly minimised by proper care of the knives, regulation of the pressure bar and preliminary treatment of the log. Rotary cut stock is generally "flat grained" owing to the method of cutting, but figured material may be obtained from irregularly shaped logs or by moving the working axis away from the true central axis of the log.

This, in extreme cases, especially when dealing with burls and roots, is effected by bolting the wood on to a steel stay bar which is mounted between the chucks. The cutting surface therefore moves round on an enlarged arc and approches the slicing method in character and effect.

Rotary cutting is the cheapest method of producing veneer as there is very little waste in the conversion of the whole log and also it is the most rapid for producing quantity. The process is applicable to nearly all classes of woods, but is specially suited for softwoods and the softer hardwoods giving clean cylindrical logs. Its drawback is that matched stock is almost impossible to obtain and the best advantage cannot be taken of valuable figured logs.

It is used extensively in producing stock for cross banding and cores, and also for face material where suitable for the purpose required. The thicknesses cut vary over a wide range from 1/110 inch to 5/16 inch depending on the species of the wood and the preliminary treatment.

The veneer cut by this method finds its main use in the manufacture of ply wood, although a very large consumer is the container industry for the making of boxes, baskets, crates, hampers and the like.

CHAPTER III.—THE PREPARATION OF MATERIAL FOR THE CUTTING OF VENEERS.

To a very large extent, the degree of success in the cutting of veneers depends on the preliminary treatment of the material. This is more particularly the case in the slicing and rotary methods, where it is almost always necessary to soften the fibres of the wood in order that they will cut readily without tearing.

With the sawing process, no preliminary treatment is necessary. The logs or squares are cut into suitable flitches and are sawn cold and in the green.

When using the other two methods, the fibres are usually softened by steaming or boiling the material in water.

The softening effect is caused by the application of heat to the wood and not by the wetting effect of the water or steam which is simply utilized as a heating medium and also to prevent surface drying which would automatically occur if heat alone were applied.

Points of economic interest in this operation would appear to be the length of time taken to heat the wood to the required temperature to effect the necessary softening, and the optimium temperatures to maintain during that period.

Time always is an economic factor in all industries and reflects its influence in this operation too. The shorter the time required to subject the wood to the heat, the less the installation required for steaming chambers or boiling vats. But good results must not be sacrificed to time, as a reducing in this latter component will necessitate higher temperatures which may in turn break down or destroy the character of the wood.

In this connexion it is interesting to consider the work of R.M. Wirka, of the United States Forest Products Bureau entitled "Temperature and Moisture Changes in Wood under Steaming Treatment", prepared for the American Wood Preservers' Association in February 1925.

In experiments carried out in steaming logs of different sizes at 212° F., it was found that the internal temperature of the wood rises at first very slowly and then very rapidly, but that as it approaches the temperature of the steam, the change again becomes slow. Further deductions from the series of tests are that the time required per inch of diameter to effect a definite temperature change increases with the diameter, that is, to produce a certain temperature change, more time is needed for each inch of the larger specimens than for each inch of the smaller ones. This variation is obviously due to the decrease in the heating surface per cubic foot of volume with increasing diameters, but no mathematical relationship has been established.

Even were such a relationship established, it is very unlikely that in the veneer industry any practical use could be made of it. The various irregular lengths and shapes of logs to be cut, fungi hollows, seasoning checks and shakes, presence of sap wood, are all factors militating with the application of any definite set of rules and figures. Even with the same species there are differences in moisture content and density of structure which would all have to be considered.

Hence the fixing of times and temperatures must remain a matter of personal judgment based on experience. As a general guide in dealing with South Indian species in this respect, the practices of several of the largest veneer mills in the United States of America, cutting mainly tropical hardwoods, have been collected and are set forth as an appendix to this work. As regards American species, roughly speaking, using boiling water, oak needs 24—48 hours, walnut 6—12 hours, gum 12—24 hours, and cotton wood no boiling at all.

The Boiling Process.

The boiling or softening of the logs in heated water is carried out in large vats or pits, which are either built up of sheet metal or else constructed of brick or concrete. The brick or concrete type is the more common owing to the corrosive action on the metal of the wood extracts brought out by the boiling.

The metal vats are usually of fairly small dimensions 10 to 15 feet long, by 10 feet wide, by 6 feet deep—specially installed for dealing with one separate species in special sizes such as mahogany flitches for slicing. It is advisable to support and surround the metal on all sides with earth or wood to prevent outside radiation of heat and so to conserve and maintain the temperature of the water.

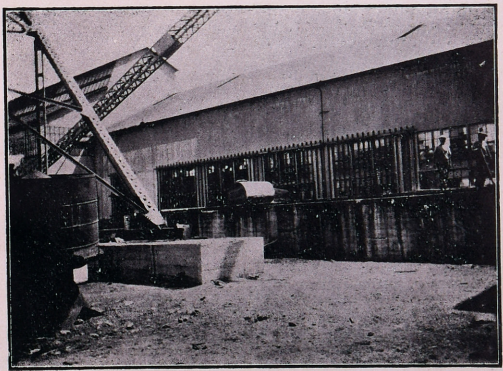
In the case of brick or concrete, the walls are built thick enough to obtain this requisite, and the structure is usually of fairly large dimensions according to the class of material which is being treated.

The required temperature of the water is obtained by the use of steam pipes which are laid along the bottom and sides of the pits, and suitably protected from damage from the heavy logs which might otherwise rest on them. In some cases a closed steam circuit is used, and in other cases, the steam may be bubbled up through the water.

The water in time becomes extremely dirty from the saps and extracts boiled out of the wood, but this condition does not seem to discolour or affect wood put in subsequently. The water therefore is seldom changed, but a cleaning out of the tank or pit should be made at suitable intervals to remove refuse, mud, and bark, which may collect in the bottom and so embed the steam pipes, preventing the effective radiation of heat to the water.

Boiling pits or vats may be built either above the ground level or below it. The former are the more safe as better precautions may be taken to prevent workmen and others from walking or passing over the pit covers, as many fatal accidents have occurred from men falling into the boiling water in this way. If ground pits are used, they should be railed off or suitably marked to prevent such occurrences.

5. *A BOILING TANK* LINED WITH SHEET METAL AND PROTECTED BY A LUMBER OUTER WALL TO PREVENT RADIATION. THE COVERS ARE OF WOOD. NOTE THE SWINGING DERRICK FOR TRANSFERRING THE LOGS FROM THE TANK TO THE MILL.



6. *CONCRETE BOILING VATS* SHOWING A LOG READY TO BE PUT IN BEFORE BEING CUT BY THE ROTARY PROCESS.

A very important point in the building or construction of boiling pits is their location in the plant. The location should be such that the logs or flitches can be easily transported to them from the breaking-down and cross-cut saws, and also that the material when ready to be cut into veneers can be picked from the water and placed actually on or near the veneer-cutting machine.

A small swinging derrick crane fitted with tong attachment is most suited for putting the material in, and taking it out, of the water.

The pits or vats should be covered with a heavy and close fitting cover generally made of wood, and stout enough to bear the weight of any men who may be moving about on them in the course of their work. Bolts and rings are necessary at the corners or centres so that the covers may be easily lifted off by means of the cranes when it is desired to put in or remove any logs.

The water is seldom allowed to cool very much when the plant is in operation—the minimum temperature being about 120—130° F. The maximum temperature used of course depends on the species of wood being treated but rarely exceeds 200° F.—the average being about 180° F.

The logs are invariably put into the pits with the bark on, for two reasons. Firstly, the peeling off of the bark, which is essential before rotary cutting just prior to placing the log in the lathe, ensures the cleanest material being fed to the knife. All the mud and grit to which the log is subject in the dirty water in the vat and in the subsequent handling, is taken off with the bark, whilst if this operation were performed before boiling, the outer wood might become embedded with matter which would prove disastrous to the knife-edge. The second reason is that of economy. The barking operation is much easier after the log has been subjected to the hot water than before when it is in the natural green state.

The Steaming Process.

As its name implies, the steaming process employs steam as a means of softening the fibres of the wood. The wood is put into the steam vats or chambers, which are so fitted with pipes as to allow live steam to be released and controlled as desired. The steam vat or chamber is a smaller unit than a boiling vat or pit—the steam vat being generally constructed of sheet metal, properly insulated, about 6 feet wide, by 5 feet deep, and 10—12 feet in length, and fitted with a close fitting cover. It is utilized almost entirely for treating clear-cut flitches of species which are not liable to be injured by the steam heat, such as mahogany. The flitches are put in and removed by means of a suitable overhead crane, and the vat should be near the slicing machine to minimise labour.

The steaming chamber is almost non-existant in the hardwood industry but is employed in the cutting of softwoods where logs of very large size are being converted by the rotary method. Such logs are sometimes so large that they cannot be put into and taken from the water or steaming vats by the means of tongs, and as it would be almost impossible to utilize chains or chokers, resort is made to placing the logs on small trucks on rails. They are thus run into a small closed room, generally built of heavy lumber or brick, and steam is turned on until the required degree of softness is obtained. With many of the softwoods, especially Douglas fir, this method is very suited as the higher temperatures obtained with the use of steam hastens the softening and does not harm the fibre.

Steaming *versus* Boiling.

In considering the advantages and disadvantages of these two methods with a view to the employment of one or the other, it is imperative to study the requirements and characteristics of the wood to be treated. For instance, oak should not be subjected to high steam temperatures as the cell structure may break down, while on the other hand, the mahoganies are not affected in this respect.

The steam process is one which is clean, and easily repairable if damage occurs to the pipes in the vat or chamber. High temperatures can be obtained quickly and maintained. Units are necessarily small and so are flexible in conforming to the fluctuating demands of the machine and labour element—they can be shut down or started up quite easily. Also the liability to danger to the staff employed is small.

As a disadvantage, there is the comparative high cost in a large plant of installing many small units. If certain species require treating for many days, the expenditure in steam is excessive and constant supervision must be maintained.

The boiling process is most suited where logs have to be treated over a great number of hours, as the water is less liable to fluctuations in temperature. Heat is conserved by never allowing the water to cool, so that a fresh charge of logs into the pits does not necessitate the employment of a fresh supply of steam to heat up the wood from the cold state. It also enables a more gentle and fool-proof treatment to be given to delicate species and less skilful supervision is required. And further, supplies of all sizes of logs are always available to feed to the machines for cutting, as it is possible to arrange considerable storage in the pits of material kept warm by the heated water.

The disadvantages are that any repairs necessary to the heating coils are difficult to effect and necessitate the emptying of the pits with a consequent danger of shortage of supplies of logs to the machines. The pits must be kept water-tight. There is also the danger, already referred to, of danger to workmen, by falling into the boiling water, which is no uncommon occurrence.

Summing up, it may be said that the boiling process is more suited to the treating of tropical hardwoods, as comparatively low temperatures over long periods seem more effective and less liable to cause damage to the wood than high temperatures over short periods.

Time and Temperature Factors in the Steam and Boiling Processes.

It has already been stated that the time and temperature factors cannot be estimated by any definite set of rules, and this is borne out by the actual practical experiences in dealing with the different species as enumerated in the Appendix. It stands to reason that a log or flitch must be uniformly heated throughout its dimensions. If the wood is not heated sufficiently, it will generally crack and check badly as it is being cut. This is especially noticeable in the rotary cutting. In the slicing process, the knife will force its way into the wood and be drawn out again by the tension of the metal of the machine so that a wavy surface will be cut if the material is too hard. In such a case, it is necessary to subject the wood to further treatment.

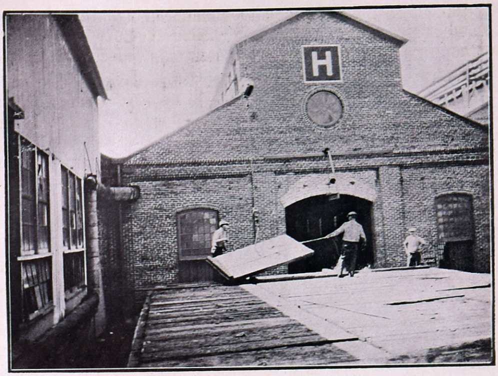
If the boiling or steaming has been excessive, the cell structure may even be broken down which will show up to a marked extent when the veneer is being dried. Another sign of overtreating is the obtaining of a 'fuzz' or 'fur' cut—the cut surface of the veneer being very rough due to the fact that the fibres are too soft and have compressed themselves past the knife rather than be cut by it. In such a case it is the custom to allow the log or flitch to cool for a few hours before further cutting.

Another point to be considered is the effect of boiling or steaming on the colour and lustre of the wood. This is of great importance in dealing with tropical hardwoods chosen on account of their ornamental qualities. For instance, Indian laurel wood, to be sliced, requires boiling for five weeks and is then found to have lost all its life and lustre. Rosewood, if boiled too long, is said to contract a dirty purple stain which is highly detrimental to its use as a veneer inlay wood.

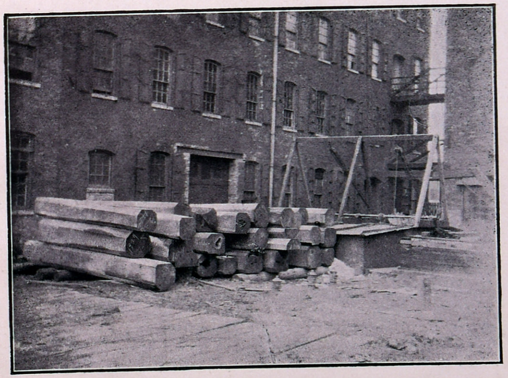
Such points must all be considered in selecting the most suitable method of cutting any wood into veneer.

CHAPTER IV.—THE TRIMMING OF VENEERS.

Veneers which are sliced or sawn are almost invariably taken from the veneer machine in bundles representing the original flitch, and are subsequently handled intact until sold or passed to the final manufacturing plant. The veneer, however, from the rotary machine, coming off as it does, in one continuous sheet, must be cut up into sizes convenient for handling and disposal. As the veneer is peeled off, it is led on to a long table fitted with live rolls. The operators, one on either side of this table, inspect the material and break it into sheets piling four or five sheets one on the top of the other. The piles are transported by the live rolls along the



7. *THE HEAVY WOODEN COVERS ON A CONCRETE BOILING TANK.* NOTE THE BOLTS AND RINGS TO FACILITATE EASY REMOVAL BY THE LOG CRANE.



8. *A PILE OF WALNUT LOGS READY FOR STEAMING* IN THE SMALL SHEET METAL *STEAMING* VATS AT ITS FURTHER END. NOTE THE SMALL SIZE OF THIS UNIT COMPARED WITH THE *BOILING* PITS SHOWN IN THE PREVIOUS ILLUSTRATIONS.

Of the methods enumerated, the one to be employed in any particular operation will depend largely on the type of cutting being carried out. Where the rotary process is in use and quantity production is aimed at, artificial drying is necessary and the endless-belt type of dryer is recommended.

But where the sawing process is being used for the cutting of ornamental hardwoods which are usually difficult to dry artificially, natural drying in a room seems more desirable as a better and more even drying is obtained, the resultant material is a better product, and moreover there is not the big overhead charges and expert supervision necessitated by the installation of elaborate artificial dryers.

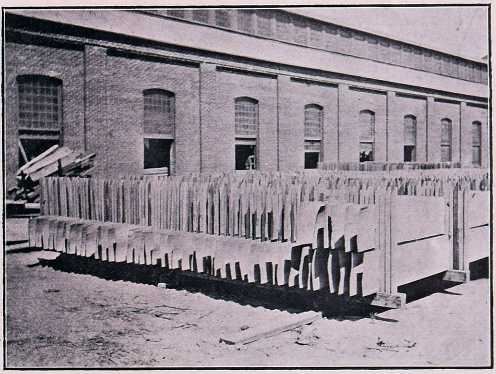
CHAPTER VI.—THE MARKETING OF VENEERS.

In the marketing of veneers, two distinct classes must be recognized—that being used for ordinary veneer purposes such as for facing, cross-banding, and backing, and that which has a special value for ornamental purposes on account of its grain, colour or figure.

The former is sold as a standard commodity under definite sets of grading rules as laid down by the trade, just as lumber is graded, and rates are quoted on a square foot basis or per 1,000 square feet.

With the latter class, the characteristics will vary with each log or flitch, and although rates are quoted on the square foot basis, yet the whole log or flitch is disposed of as one unit.

In advertising such a unit, it is customary to submit three sample sheets taken from different parts of the pile—one from about a quarter of the way through, the second from about half-way, and the third from about three-quarters through, together with the number of superficial feet of veneer in the lot. This gives the purchaser a fair idea of the class of veneer contained in the unit, and the quantity available, and enables him to select his material for any special purpose for which he may require it.



9. *DRYING MAHOGANY VENEERS IN THE OPEN AIR.* THE VENEER SHEETS ARE HELD FIRMLY BY MEANS OF THE WOODEN UPRIGHTS, AND DRY FAIRLY FLAT.

PART III.

The future of the Veneer Industry in South India.

In the foregoing chapters an attempt has been made to show how the introduction of the veneer industry into South India could aid in the economic development of its hard-wood resources, and a description has been given of the industry itself. A survey of the experiences gained in attempting to cut a few of the *ornamental woods* of South India as set forth in the Appendix will illustrate the advisability of limiting the conversion of all such species to the sawing method.

In a country where initial expense and outlay are of vital importance, where the necessary machinery and service are difficult to obtain, and where expert labour is scarce, the simplicity of the operation must count a great deal.

In this connection, the sawing process again seems the most suitable as boiling pits and vats are not required, heavy foundations and machinery are not necessary, and expensive dryers can be dispensed with.

Moreover, the requirements of the overseas markets can more suitably be met. In those countries, the common practice is to cut all sawn veneers for ornamental purposes to 1/20 inch thicknesses, whilst with sliced ornamental veneers the thicknesses are usually 1/50 inch in Europe and 1/28 inch in America. Thus a standard 1/20 inch sawn veneer would conform to the practices in both markets, as well as at the same time producing the finest grade of material suitable for all purposes.

The question of the wasteful results of sawing over the slicing and rotary cutting methods would not be of much consequence as raw material is comparatively plentiful and cheap.

Such veneers would be sold by sample, the bulk being retained in India where storage space is not expensive and fairly abundant. This would obviate the present costly practice of shipping logs to London entailing freight rates and high labour dues in that market with consequent storage fees, and then, as is now the case, if America requires such material, of rehandling it and importing it into that country.

In dealing with the sawing of ornamental wood veneers, the natural means of drying of the sheets is recommended. Ground space is cheap and drying sheds easily erected.

And so, all points being considered, the installation of small *sawing* veneer plants would appear to offer no difficulties from an economic point and is the type most suited to aid in the *development of the 'overseas' markets* for South Indian ornamental woods.

As regards the development of '*home*' markets, attention must be paid to the manufacture of ply wood and for this, a *rotary lathe* plant must be installed. The ply wood and panel industry is a business of its own and it is not proposed to deal with it in this note. The plant required is considerable and a higher outlay is necessary than for the simple cutting of sawn veneers. The power required is larger, rotary lathes are essential, water storage is necessary to keep the logs from checking and splitting in the hot tropical conditions, artificial dryers must be installed and the question of glues must be considered. If possible, the ply-wood plant should form a part of a big saw mill and extraction scheme in order that the logs may be most suitably distributed between the veneer plant and the saw mill.

However, it is considered that there is a big economic future for such an installation in South India especially if the sites chosen were on the West Coast where water for power and storage is available, and near which the supplies of all the finest species of timber suited for the purpose are to be found.

The tea box and packing case industry would in itself justify a ply-wood plant added to which there are the possibilities of developing markets for panels and ply-wood for temporary partitions, motor-car bodies, railway carriage construction, auditorium seating, and also as backings for high ornamental veneered panel stock.

Thus the veneer industry is one which is very closely bound up with the future development of the forests of South India and it is hoped that this small contribution may be of some assistance to those interested in the work.

APPENDIX.—SUGGESTED TREATMENTS FOR CERTAIN INDIAN HARD WOODS IN THEIR CONVERSION INTO VENEERS.

Laurel Wood (Terminalia tomentosa) (from South India).

This is a very difficult wood to deal with. Owing to its expensiveness, efforts have been made to convert it into veneers by the slicing method. The rotary method is unsuitable as it is desired in cutting to bring out its rich ornamental grain and figure.

To soften the fibres, it has been found necessary to boil it for periods approximating five weeks, but this has the effect of taking the life out of the wood and leaving it dull and uninteresting. In England it is being concerted entirely by sawing, and this method is the only one recommended. Thicknesses should be 1/20″—the usual sawing dimension.

Rose Wood (Dalbergia latifolia) (from South India).

This is a difficult wood to deal with, but nevertheless is widely used as a veneer.

In Europe it is employed largely in the piano industry and for such purpose is cut on the rotary machine. The finish applied always results in a deep handsome colour, and figuring or grain effect is not necessary.

In the United States, rosewood is in demand more for furniture, panel, and inlay work, with the handsome "yellow and blue colour" present in the striped grain. This can only be obtained from the green log. If the wood is allowed to season in the log, the colour changes to dark purple hue with a characteristic purple staining, which makes it unsuitable for the purpose required. Rose wood in the United States of America is always sliced or sawn. The latter is advocated as boiling, or steaming is said to induce the staining, and the colouring is lost. If slicing is employed, the temperature should range from 180° to 212° F. for three or four days.

Satin Wood (Chlororylon swieteenia) (from Ceylon and South India).

This is a wood of considerable value and is renowned for its wonderful texture and effect. It is always cut into fitches and either sawn or sliced. Again the former is recommended to obtain the best results.

Efforts have been made to slice it and it has been found necessary to boil it at 190° to 212° F. for three or four days. This stringent treatment has the effect of destroy ing to a great extent the "life" of the wood. Even after such softening, it is hard to cut especially with a fine cutting knife with a new edge. The wood seems to feed the blade into itself, so causing a wavy or uneven cutting. This may be partly overcome by using a blade with the edge taken off and having plenty of body directly behind the cutting edge.

Tulip Wood (Dalbergia Oleveri) (from Burma, India).

A wood of small size but of great beauty on account of its striped pink and white colouring. It is very hard to slice, and if boiled loses its distinctive features. The necessary treatment would be two weeks heating in water at 150° F., but every recommendation is put forward to use the sawing method. The veneer is used in ornamental inlay work.

2. Other South Indian woods which should receive attention in the future, and which appear to be eminently suited for manufacturing into veneers are:—

Almond wood (Chickrassia tabularis)
Satinee (Hardwickia pinnata)
Honey wood (Pterocarpus marsupium) } For furniture, especially for bedroom and sitting room use.

Haldu (Adina cordifolia), a light coloured, even textured wood, suitable for furnitrue and boudoir panelling.

White mahogany (Canarium spp.) for furniture, and as a face veneer for plywood for interior of drawers, etc.

These woods have all been utilized as veneers in England, but the quantities converted have not been sufficient to specify any definite method of cutting or preliminary treatment.

APPENDIX B

FOREST EXPLOITATION

IN THE

PHILIPPINE ISLANDS

WITH SPECIAL REFERENCE TO THE RELATIONSHIP BETWEEN THE BUREAU OF FORESTRY AND THE PRIVATE LUMBERING COMPANIES OPERATING IN GOVERNMENT FORESTS AND THE MECHANICAL LOGGING AND MILLING METHODS USED TOGETHER WITH PERTINENT SUGGESTIONS FOR MADRAS

BY

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MADRAS

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INTRODUCTION.

The Philippine Islands having pioneered the application of modern mechanical methods to tropical forest exploitation and having as a result successfully developed a large tropical hardwood lumber industry, I toured the Philippines for a fortnight on my way Home to the United States in the Autumn of 1925 in order to observe the methods and practices in use and to obtain ideas applicable to the forest development work being carried on in Madras Presidency. The many points of similarity of conditions in the Philippine Islands and in South India make the experience of the former of particular interest and value to Madras—lying in the same latitude (the Philippines extending from 6 degrees to 18 degrees, North); having similar climatic conditions with a large stand of tropical timbers of, in many cases, the same genera growing on ground of rough and broken topography; with the same type of political administration (legislative powers in the Philippines being vested in a legislature elected by the people and executive powers in a Governor appointed by the controlling foreign power); and peopled by diversified Asiatic, European and Eurasian races.

In this report I present a chronology of my tour, an outline of the organization governing the relations between the Forest Department and the private companies engaged in forest exploitation, technical descriptions of forest operations visited, and a discussion of the possibility of introduction into Madras of certain practices observed in the Philippine Islands.

TOUR PROGRAMME IN THE PHILIPPINE ISLANDS.

I arrived in Manila, P.I. on 1st September 1925 and called the next day at the Bureau of Forestry. Mr. Arthur F. Fischer, Director of Forestry, and Mr. Florencio Tamesis, Chief of the Division of Utilization and Saw Mills, gave me a cordial welcome and, on learning the object of my visit, outlined a tour programme, had travelling arrangements made and telegraphed ahead informing local managers and forest officers of my impending arrival. I departed that night by boat for Negros Island, some 340 miles south. Arriving at Pulapandan, Negros Occidental, on the morning of the 4th, I motored 80 kilometres to Cadiz, where the Negros Philippine Lumber Co. is located. I was met by Mr. Whitefield, resident-manager, who extended me the hospitality of his home, and devoted considerable time to showing me around the operation. I spent the afternoon in the saw mill, which cuts 80,000 Board feet or approximately 7,000 cubic feet of lumber daily, and the following day in the logging operations. On the 6th I travelled on to Fabrica, an hour's ride distant, where the Insular Lumber Company, the largest lumbering operation in the Philippines with, I believe, the largest hardwood mill in the world, is situated. I stopped with Mr. Thomas, the General Superintendent, who extended the same cordial welcome, and evinced the same willingness to give information requested, that I received everywhere in the Philippines.

I spent a day in the saw mill which is cutting 200,000 board feet or about 17,000 cubic feet daily, in two shifts, and another day in the woods. On the 8th I motored to Silay, ferried across Zimmoras Strait to Iloilo and caught the boat for Manila reaching the capital city on the 10th. Mr. Fischer had arranged for me to meet General Leonard Wood, Governor-General of the Philippine Islands, at Malacanan Palace, and from the conversation I had with the Governor-General it was evident that the Government consider the Bureau of Forestry one of the most important of their revenue-producing departments. I also had a talk with Insular Auditor, Mr. Ben F. Wright, whose official position corresponds with that of Accountant-General in India, one of the most influential men in the Philippines. I attended a meeting of the Manila Rotary Club and met a number of representative businessmen of many nationalities. On the 11th I journeyed across Manila Bay to Limay to see the Veneer Plant and Saw Mill of the Cadwalladar-Gibson Lumber Company

returning to Manila the following day. On the 13th I visited the Forest School at Los Banos, and the day preceding my sailing for America on the 15th was occupied in discussions with Mr. Harris, General Manager of the Negros Philippines Lumber Company, and Mr. Bradney, General Manager of the Insular Lumber Company, and obtaining further data and information from the office of the Bureau of Forestry.

THE BUREAU OF FORESTRY AND PRIVATE LUMBERING COMPANIES.

Before taking up a detailed discussion of the methods used by the typical lumbering operations visited, it may be well to consider briefly the organization by which the Bureau of Forestry administers the public forests of the Philippine Islands and the relationship between the Bureau and the private lumbering companies. The forested area is 72,224 square miles or 63·1 per cent of the total area of the Islands. 64,127 square miles or 88·6 per cent are designated as commercial forests and the remaining 11·4 per cent as second growth forests valuable for firewood. The total stand of saw timber is estimated at 20 billion cubic feet or an average of 487 cubic feet per acre; with the stand per acre in tracts considered by private lumbering interests suitable for commercial exploitation varying from 10,000 to 30,000 board feet (830 to 2,500 cubic feet).

LICENCE SYSTEM.

To responsible parties desiring to engage in lumbering or in extraction of minor forest products the Bureau of Forestry grants either annual or long-term licences. The applicant for a licence furnishes a bond to guarantee fulfilment of the licence terms. Long-term licence-agreements for exclusive right to a large tract, are generally granted only to companies of financial integrity who will engage in lumbering on a large scale. The licence specifies that a certain investment in logging and milling equipment will be made, and establishes the minimum amount of timber per annum that must be cut. There are now 13 long-term lumbering contracts in force covering areas varying from 27 to 448 square miles, totalling 1,532 square miles. The daily capacity of the mills operating on these concessions varies from 5,000 to 120,000 board feet (400 cubic feet to 10,000 cubic feet) and totals 478,000 board feet (40,000 cubic feet). In 1922 they actually produced 89,587,000 board feet (7,500,000 cubic feet). The ordinary annual licences are renewed each year as long as the holder complies with the forest regulations and the terms of the licence. There are 33 saw mills of from 1,000 to 20,000 board feet (83 to 1,700 cubic feet) daily capacity holding annual licences.

LUMBER PRODUCTION.

In 1922 (the last year for which complete figures are available) the saw mill companies operating in Government forests employed an average of 3,799 labourers and produced a total of 100,735,000 board feet (8,394,583 cubic feet). The total capital invested was Pesos 15,230,000 (Rs. 2,13,22,000). There are also a score of mills in the Philippine Islands which do not hold Government timber licences, but operate on private lands or buy logs from small licensees engaged in logging only. These mills cut eleven and a half million board feet in 1922, employing an average of 765 labourers and with an investment of Pesos 2,110,000 (Rs. 29,54,000).

BASIS OF PAYMENT FOR GOVERNMENT TIMBER.

The licensee pays monthly for the timber cut, based on the scale or measurement of the felled trees or logs by the Bureau of Forestry scalers. Under a law passed in 1915 the solid content of the log exclusive of bark with natural defect deducted of all timber taken from public forest must be measured. Under the system in force prior to 1915, licensees paid on the basis of lumber produced. This was found to encourage waste and to penalize the progressive companies who secured a high utilization of their timber, while the wasteful operations cut a proportionately larger volume of Government timber to produce the same amount of lumber, thus paying lower charges. Under the present system the Government gets a more equitable revenue for its timber and an incentive is given to using the best methods of logging and milling. and saving waste.

LOG SCALING.

The metric system having been adopted by the Philippine Government, logs are scaled in cubic meters. The usual practice is for the Bureau of Forestry scaler to go into the forest after the trees in a given area have been felled and bucked into logs and measure the diameter of each log inside bark at the small end to the nearest even centimeter and the length of the log to the nearest decimeter. With logs over 8 meters long the middle diameter or the average of small and large end is taken. These measurements and the species are entered in a scale book, the cubic volume being taken from tables published by the Bureau. If the log is irregular or unsound, the loss in merchantable timber is estimated and recorded by the scaler based on judgment and experience gained from making systematic mill studies of the cutting up of logs in the saw mill. The loss in merchantable timber because of defect is compensated for by deducting a certain percentage from the volume of the log, although with some classes of defect the length or diameter of the log is decreased. It is worthy of note that when logs are sniped or nosed or drag holes cut, the original size of the log is scaled. After being scaled the log is stamped. The scalers in each district are under the supervision of a Forest Officer who frequently checks their work to insure accuracy. Weekly and monthly reports giving the total of cubic meters of each species scaled, and charges to be collected from the licensee are submitted to the Head Office of the Bureau. A detailed report of the activities of the mill and logging operation showing time worked, output, shipments, operating costs, etc., are also rendered, enabling the Bureau to keep a close check on what the licensee is doing.

STUMPAGE RATES.

All the woods growing in the Philippine Islands are placed in one of four groups based on their durability and value for construction and other purposes from the local standpoint only. The rates of payment for timber in each group are fixed by law, as follows :—

First group—Pesos 2·50 per cubic meter; or the equivalent of As. 1·7 per cubic foot.

Second group—Pesos 1·50 (Rs. 2/2); per cubic meter; or the equivalent of one anna per cubic foot.

Third group—Peso 1·00 (Rs. 1/6); per cubic meter; or the equivalent of 7 pies per cubic foot.

Fourth group—Peso 0·50 (Re. 0/11); per cubic meter; or the equivalent of 4 pies per cubic foot.

The first group includes the hard durable woods suitable for exposed construction and fine cabinet work in the tropics. No great quantity of these are found. The second group consists of strong woods only a little inferior to those in group 1. They are not found in marketable quantities. The third group contains the softer and less durable (for the tropics) timbers, which are found in the largest commercial quantities. These are the important export woods which are sold abroad as Philippine Mahagony. The fourth group woods are unsuitable for export or are not found in sufficiently large quantities to be exploited.

A list of the timbers under each group will be found in the appendix to this report. The characteristics of the more important woods will be discussed in a later paragraph.

ORGANIZATION OF THE BUREAU OF FORESTRY.

With the Bureau of Forestry taking such an active part in the control of forest exploitation as well as the usual functions of forest management an organization differing radically from that in India has been developed. The Bureau, which is headed by a Director of Forestry, is divided into five divisions, each of which has a Chief with the rank of Forester (corresponding to Conservator in India) in charge. The division of forest management grants licences and special permits, formulates and carries out rules and plans for the protection of the forest, and administers and inspects

NOTE.—In the Philippines all graduates with degrees in Forestry are ranked as "Foresters". A "division" corresponds to a "circle" in India.

the thirteen forest districts and sixty stations. The field and office staff consists of 5 foresters, 6 forest supervisors, 83 rangers, 44 guards and 15 clerks. The division of investigation undertakes field and laboratory research in utilization, wood technology, silviculture, entomology, etc., establishes forest nurseries, collects and distributes seed and does reconnaissance and reforestation. The forest school which is described in another paragraph comes under this division also. The staff includes five foresters, six rangers, one librarian and guards, nurserymen and clerks.

ACTIVITIES OF UTILIZATION DIVISION.

The activities of the division of saw mills and utilization include scaling the timber felled by licensees, mill studies, collection and compilation of lumbering and lumber marketing records and statistics, assisting lumbering companies in extending their markets and increasing the standard of utilization, finding new uses of lesser known woods, and identification, grading and inspection of lumber. The grading and inspection of export lumber cargoes is becoming an increasingly important branch of the work of this division. Much lumber is sold to foreign buyers with the agreement that it be accompanied by a certificate from a Government Inspector as to species, grade and condition, and this has been very valuable in popularizing Philippine woods abroad, as the buyer knows just what he is getting. A carpenter's shop run by the division for turning out cabinet work of all kinds is an important experimental laboratory in the use and handling of new woods.

The activities of the division of forest lands and maps include land classification, determination of forest zones, reserves and commercial forests, prosecution of public forest land cases and registration of private forest lands and forest valuation surveying, mapping and drafting. A valuable stock and topographic map is being compiled by requiring forest officers everywhere to take topographic notes and valuation surveys or cruises whenever they traverse a new area. This data is sent to the lands and maps divisions and compiled. In this manner every year over a thousand hectares of valuation surveys and over ten thousand kilometres of topographic trail notes are added by the district staff in the course of their regular work.

The administrative division has general supervision of the clerical work of the Bureau—accounts, records statistics, translation, etc., and maintains the library.

TECHNICAL DESCRIPTION OF LUMBERING OPERATIONS VISITED.

Insular Lumber Company Operations.

The Insular Lumber Company, an American Corporation, has a twenty-year licence to cut timber on an area of 139 square miles of public forest in Negros Occidental Province. The timber consists principally of *tangile*, *apitong*, red *lauan* and white *lauan*, averaging 20,000 board feet (1,666 cubic feet) to the acre. The topography is similar to that of the forested areas in South Mangalore division, South Kanara.

LOGGING.

Logging is done entirely by mechanical methods. A standard (4 feet 8½ inches) gauge main-line logging railroad line runs from the saw mill up along the main river draining the forest area, as far as the maximum 4 per cent grade can be followed,—a distance of some 12 miles. A net-work of logging railroad spurs are built throughout the forest, a distance of 1,200 to 1,600 feet apart on grades running up to 6 per cent and occasionally more for short stretches. The merchantable timber is felled with saws, axes and wedges, and bucked into an average of 32 feet long logs with saws. After bucking, the felled timber is scaled or measured by Government scalers. Each scaler covers 50,000 board feet (4,000 cubic feet) or about 2 acres a day. The logs are yarded to the railroad spurs by 11 × 14 steam donkey engines using the high lead system. The yarding distance is usually 600—800 feet, although on long corners they may go out 1,000—1,200 feet. An extension loading drum on the yarder loads the logs on railway flat cars with the single tong system a car-load averaging 4,000 board feet (333 cubic feet). The average yarded and loaded per side (one

engine unit) is 25,000 to 30,000 board feet (2,083—2,500 cubic feet) per $9\frac{1}{2}$ hours a day. The days output of 6 or 7 cars is hauled by a geared locomotive to the main-line, where a log train is assembled by a switch engine and hauled by a 100-ton Baldwin articulated compound locomotive to the dump at the saw mill log pond. The transportation equipment consists of four Shay geared locomotive of 40 to 60 tons, two direct connected switch engines, and the 100-ton Baldwin mentioned. The logging equipment includes 16 donkey engines; 30″ high lead blocks, $1\frac{1}{8}$″ wire rope main lines and $\frac{7}{8}$″ haulback. It requires ten 'sides' to supply the mill, the others being moved and rigged ahead. The woods labour is all native with American Superintendent and foremen. Logging costs average about Pesos 18·00 per thousand board feet or the equivalent of 5 annas per cubic foot.

SAW MILLING.

The Insular Lumber Company saw mill is located at Fabrica on the bank of a river which empties into the sea a few miles distant. An artificial back-water of the river forms a log pond (a sketch plan of the saw mill and a photograph of log pond and mill is attached). This mill has been recently remodelled and improved with modern machinery. The two band sides with the head band saw breaking down the log into cants which are sawn into boards by the Pony band (the latter also cuts up the smaller logs 'alive') has an average output of 65,000 board feet (5,400 cubic feet) and the single band side 35,000 board feet (2,900 cubic feet) or a total mill output of 100,000 board feet (8,333 cubic feet) per $9\frac{1}{2}$-hour shift. This is, I believe, the largest tropical hardwood saw mill in the world. This mill is designed for quantity production at a sacrifice of quality, because 90 per cent of the timber is wormy. It is the 10 per cent of clear export grade that makes the profit. Some of the wormy stock is now being shipped to Australia as disinfected timber by virtue of being seasoned in a dry kiln. A battery of 16 Moore Dry Kilns is in operation. It takes 10 to 12 days to season a charge in these kilns. The kiln-drying cost is Pesos 4 per 1,000 board feet (1 anna per cubic foot), sawing and handling costs are about Pesos 14 per 1,000 board feet (Re. 0–3–9 per cubic foot). The percentage of utilization of the Bureau of Forestry log scale is 69 per cent. Thirty American Superintendents, foremen, sawyers and mechanics are employed in the Insular Lumber Company's operations.

GRADING.

The output of the mill is marked by graders on the sorting table into five grades—

Mark O—Clear export. No knots or worm-holes.
 ,, D—Wormy clear. Pin worm-holes but no knots permitted.
 ,, P—Quarter-master. Wormy squares special for Shanghai.
 ,, R S—Select—punk, sap and light knots permitted.
 ,, V—Common.

The principal markets are as follows:—for the clear export grade to America and Europe; the wormy clear to Australia and Japan; quarter-master grade to China; and select and common to Manila and other local markets, and to some extent China and Japan.

Lumber for shipment is lightered down the river and out to ocean-going vessels in the Visayan Sea.

One original device I noted was the use of a wire brush by the export graders on the sorting table, which when swept over the surface of a board showed up clearly the presence of pin worm-holes. The method used to buoy up non-floating species in the log pond is shown in the attached photograph. Two large logs of floating species are connected by cross timbers and the heavier non-floaters lashed to the cross timbers by ropes.

I was particularly interested in the opinion expressed by Mr. Thomas, a man of broad experience in hard woods in Mexico, Central America and the Eastern Hardwood Region of the United States, that the ideal saw mill for valuable hardwoods where

high quality of product was desired would be an 8 feet band or 6 feet pony band mill with a multiple saw edger and hand trimmers, and no re-saw because of a tendency in the latter to cut snaky lumber.

OPERATIONS OF THE NEGROS PHILIPPINE LUMBER COMPANY.

The Negros Philippine Lumber Company operates on a Government concession of 58 square miles in Negros Occidental. Their saw mill is located at Cadiz on tide water and a 15 mile standard guage railway taps the forest, with 5 miles of radiating logging spurs. The trees are felled and bucked by light American pattern saws and axes. Platforms of poles are built to get above the buttresses in felling. Logs are yarded by the high lead system to the logging spurs. Three 11 × 14 two speed steam yarders (made by Washington Iron Works) do the bulk of the yarding. In certain areas of difficult topography where railroad spur building is not feasible, a cable tramway is used for secondary transportation. This consists of a 2-inch wire rope main cable way suspended at 500 feet intervals from hangars on erected gin poles. The log is carried on a pair of two sheave rollers, being suspended by chokers of wire rope. The haul-in and haul-back lines are worked by a special steam donkey engine at the head or unloading end of the tram line, at the railway track. Another engine loads the logs on the railway cars by the crotch line system. Two high lead "sides" or units are located along the tram line and yard logs to it. The tramway has a daily capacity of 50,000 board feet (4,166 cubic feet) and the tramway cost averages pesos 4 per 1,000 board feet (one anna per cubic foot). Frequent use of tight sky-line swings is also made to save railroad building, the "swing" bringing logs to the railway from a high lead yarder a quarter of a mile distant. The average daily output per side is 25,000 to 30,000 board feet (2,080 to 2,500 cubic feet) or 10 cars averaging 3,000 board feet to the car. Railroad building costs average pesos 10,000 (Rupees 14,000) per mile, with some sections running as high as pesos 30,000 (Rupees 42,000). Falling and bucking costs a peso a 1,000 board feet (three pies per cubic foot) and logs delivered at the mill about pesos 18 (five annas 5 per cubic foot).

The Logging Superintendent, a foreman, a bull-bucker in charge of falling and bucking, a train master and a railway maintenance foreman are Americans. The rest of the crew are Philippinos. The common labour wage in the woods is equivalent to Rs. 2 per diem with yarder and locomotive engineers getting Rs. 5 to Rs. 6 per diem. Shay geared locomotives do all the rail hauling.

A sketch plan of the lay out of logging operation at the time I visited it, together with photographs of the head end of the tramway, railroad and log train is attached.

SAW MILLING.

Logs are taken from the pond, into which they are dumped from the log train, up into the mill by a log slip with a toothed endless chain. Large logs are broken down into cants by the head band saw. Small logs and cants are sawn by the pony band. Live rolls from both band saws lead to a large edger and chains pass the edged boards through the multiple-saw air-lift trimmer whence they are conveyed by live rolls to the sorting chains. Transfer rolls lead from the sorting table to re-manufacturing machines consisting of a re-saw, a pony edger and hand trimmer, all of which discharge their material back on to the sorting table. After being finally graded the lumber is pulled off on to small four-wheeled trucks running on light railway track, and taken to the planing mill or to the seasoning yard for stacking. A reference to the sketch diagram of the mill attached will clarify the above description. The output of the mill is 85,000 board feet (7,000 cubic feet) a day, and averages two million board feet (167,000 cubic feet) a month.

Inter-island shipments are loaded on coasting steamers at the mill dock; export orders are lightered out a mile to ocean-going vessels.

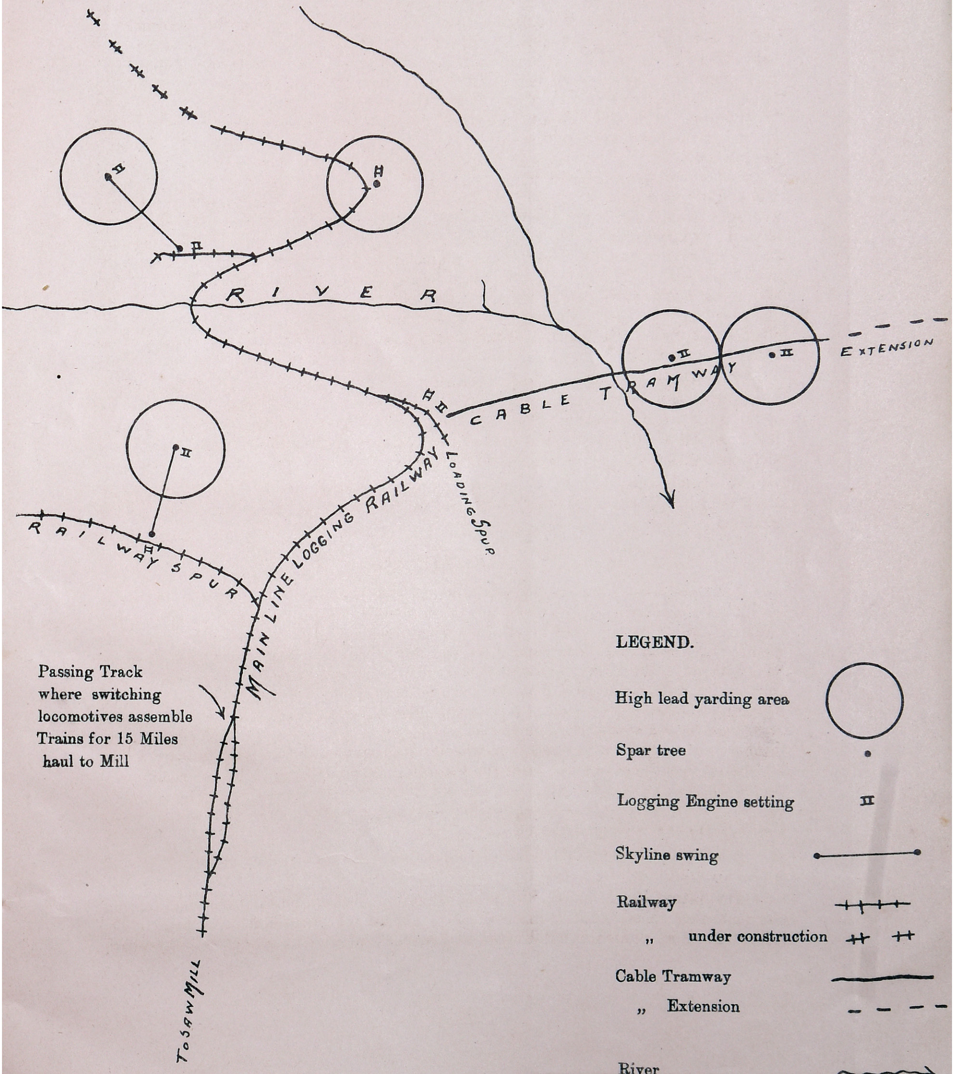
The output of the mill is 85 per cent tangile, red luan, white luan and apitong, the remaining 15 per cent being of a large variety of miscellaneous species. The percentage of utilization of the Bureau of Forestry scale is 65 per cent to 70 per cent.

Sketch Plan of

NEGROS PHILLIPINE LUMBER Co's

LOGGING OPERATIONS

During September 1925.



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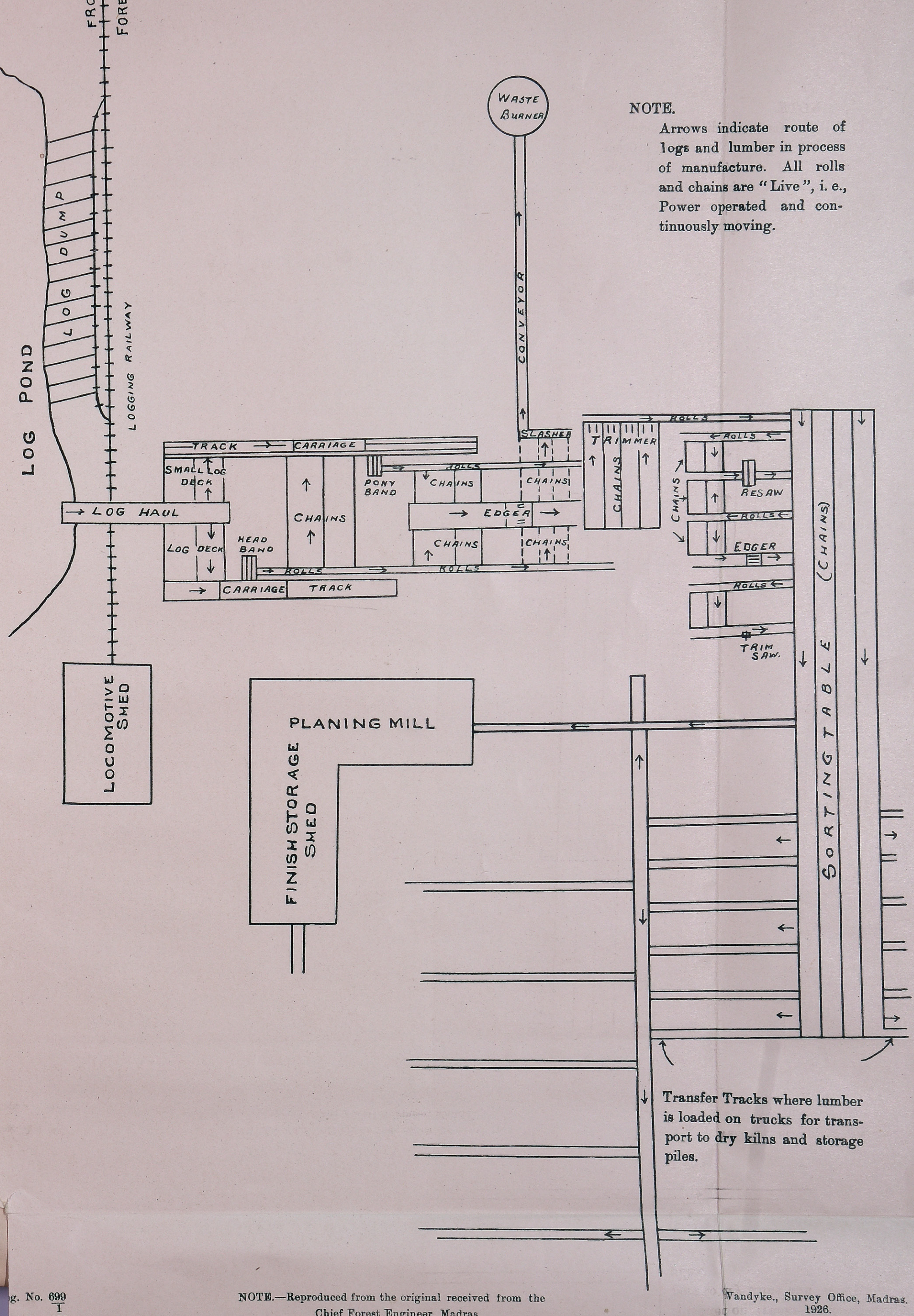
NOTE.—Reproduced from the original received from the Chief Forest Engineer, Madras.

Vandyke., Survey Office, Madras. 1926.

Plan of

NEGROS PHILLIPINE L B R. Co. SAW MILL.



NOTE.
Arrows indicate route of logs and lumber in process of manufacture. All rolls and chains are "Live", i. e., Power operated and continuously moving.

Transfer Tracks where lumber is loaded on trucks for transport to dry kilns and storage piles.

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...Vandyke., Survey Office, Madras. 1926.

HISTORY OF THE COMPANY.

The Negros Philippine Company had its beginning in 1910 in the construction of a small circular mill by an American lumberman. With the increase in business and profits as the markets for Philippine woods developed the circular was replaced with a nine feet band mill in 1917. In 1920 the Company has sold to a prominent Chinese retail lumber merchant at Manila who entrusts the entire operation to the American Managers. Despite the fact that all the clear export grade was being sold under an old contract at much less than prevailing market prices, this company paid a dividend of 45 per cent last year.

OPERATIONS OF THE CADWALLADER-GIBSON LUMBER COMPANY.

The Cadwallader-Gibson Lumber Company, an American Company with a large sales organization for tropical hardwoods in the United States, operates two concessions in the Philippine Islands, totalling several hundred square miles in area. A saw mill and veneer plant are located at Limay, on Manila Bay. Another saw mill at Paysowan, Bataan has just finished cutting the timber on the adjacent concession area, and a new mill is being built in Camorines district. The Limay mills, which was the only operation I had time to visit, receives its log supply from another Island, the companies own ship bringing a cargo of logs every few days. No mill pond is used, the logs being stored on land in a circle around a mast and swinging boom derrick, and placed by it in the log-haul to the mill. The derrick also handles veneer logs to a cross-cut saw which cuts them to proper length for the rotary veneer machine, whence they are conveyed by hand on light railway trucks. A photograph of the derrick is shown herewith.

SAW MILL.

The saw mill is a small one consisting of a band saw, edger, two hand trim saws and one two-saw equalizing trimmer. 'Dead' rolls are used throughout the mill and the sorting table has no moving chains or ropes, but simply skids. In addition to lumber the mill quarter-saws squares and cants for the veneer saws and veneer slicer, the quarter sawing bring out the ribbon grain so valued in panels and cabinet work. The output of the mill is about 25,000 bd. feet (2,000 cubic feet) a day.

VENEER PLANT.

Logs to be rotary veneered and cants to be sliced are first boiled in vats of hot water to soften the wood and then conveyed by overhead chain blocks to the respective machines. The long thin sheets from the rotary cutter, which is simply a huge lathe revolving the log against a stationary knife, are cut to suitable width by a vertical knife at the end of the off-bearing table and then passed through a roller dryer. The rotary cut material is used for cores in multiple ply panels, the less valuable species being utilized. The figured grain veneers for the outside of the panels are sliced or sawn, and being made from the more valuable species are cut thinner than the core stock. The slicer consists of a framework in which timber cants are clamped and a huge knife moving up and down which shears off a thin sheet from the cant in its descent. An automatic device moves the cant forward the width of the veneer after each slice is taken. The sliced veneers are passed through the roller dryer and then stacked until required. The finest stock is sawn, the cants from the saw mill being fed by an automatic carriage through a special veneer saw which cuts a very fine kerf. Cores for thick panels such as are used in heavy doors and table tops are made up by gluing together thin strips and edgings and other waste wood from the saw mill in clamp frames and then planing to required thickness.

MANUFACTURE OF MULTIPLE-PLY PANELS.

Since the panels manufactured are usually wider than the surface veneer sheets, two or three of the latter are joined together by gummed paper ribbons after having been edged on very fine saws to insure accurate meeting of adjoining edges. Panels are usually made up three or five ply, the procedure in the case of the former being as follows:—A surface veneer sheet is passed through a glue spreader which leaves a coating of glue on one side (the side opposite that on which the paper ribbons were

applied). The sheet is laid glued side up on a flat metal plate. A core sheet is passed through another glue spreader which coats both sides and is laid upon the first sheet with the grain running perpendicular to the grain in the latter. Another surface veneer sheet is laid, glued side down, on top of the core. This is continued until a stack of three-layer panels several feet high is piled up. Then another metal plate is placed on top and the stack rolled into a hydraulic press and pressure applied to squeeze the glued sheets firmly together. Clamps are put on to hold them in that position until dried, the press released and the stacks removed to a drying room.

After a panel is thoroughly dried it is trimmed and edged to exact size and sanded on belt or drum sanders until perfectly smooth. This sanding also removes the paper ribbons on the veneer surface. If the grain has been carefully matched it is very difficult to see where the sheets were joined. The panels are carefully inspected, and then boxed for shipment, so that no surface is left exposed to possible damage in shipping.

The Cadwallader-Gibson Veneer Plant has an output of 250,000 to 350,000 square feet a month, and is evidently a very profitable enterprise. The principal markets for its products are found in America and England.

It is anticipated that other large veneer plants will soon be established in the Philippine Islands, as it is considered more economical to manufacture locally and ship the finished veneers, rather than shipping squares and logs to veneer plants in America as is largely done at present.

This company follows the practice of progressive lumber companies in America in having a graduate Logging Engineer to plan and organize all their forest operations. In the operations visited in Negros the logging engineering was done by the Logging Superintendent with the help of the Resident Manager.

One feature of the Cadwallader-Gibson Lumber Company operations in the use of radio for inter-communication between offices, logging camps and saw mills.

BAGUIO ROPEWAY.

The problem of timber transportation in broken mountainous country with steep slopes has been solved by the Heald Lumber & Co., of Baguio Benguet, Luzon, Philippine Islands, with an aerial cable tramway. Four separate lines are used : one of 15,000 feet from the lumber yard to the saw mill, which conveys sawn material to where it can be marketed ; another of 12,000 feet from the mill to the forest with an extension of 5,000 feet to the yarding engines. A fourth line of 5,000 feet length runs from the mill to other yarding engines. These lines all convey logs to the mill.

Cable supports are placed wherever the topography permits. Some spans are as great as 3,000 to 4,000 feet between supports. Two engines at the mill and one at the extension station do the hauling. The standing line or main cable is 1 inch to $1\frac{3}{8}$ inch diameter wire rope of 6×7 construction. The hauling lines are $\frac{5}{8}$ inch, 6×9 construction. Two sheave carriers are used thus giving greater distribution of the load and less wear on the line. The length of bearing surface of the hangars varies with the span supported, 24 inches being the longest hangar. The accompanying photographs show the details of carriages, supports, etc.

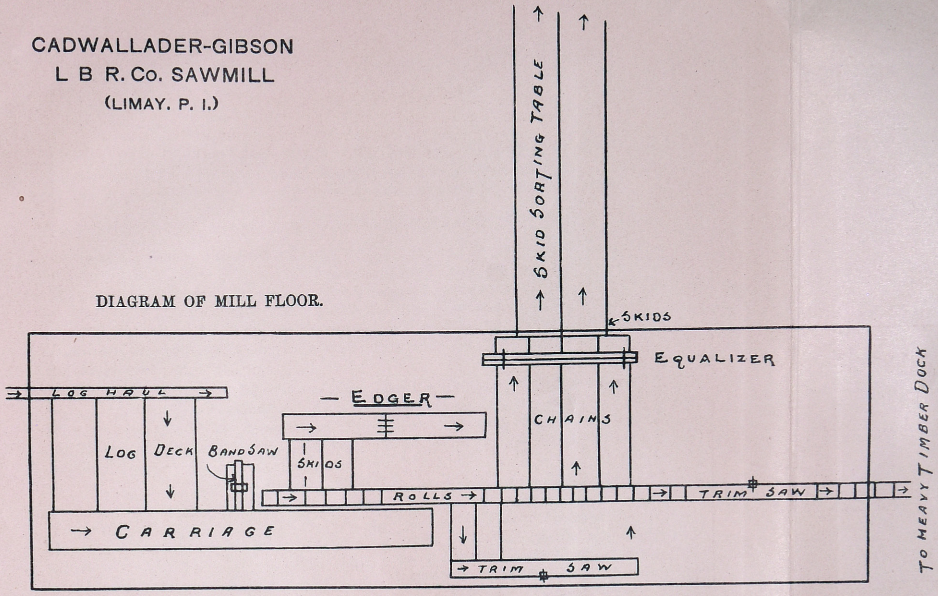
NOTE.—Not visited by the writer, but details of the ropeway obtained from the "Timberman" and photographs from Mr. Wernham.

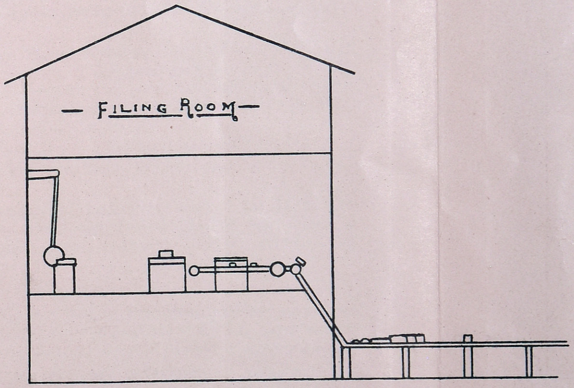
REGENERATION.

Philippine Forest Officers are not pessimistic about regeneration. While it is true that much of the cut over area is suitable for agriculture and is taken up by home-steaders after logging, no difficulty has been experienced in getting natural regeneration (particularly of the evergreen forest type) on non-agricultural land. The forest which springs up after so-called clear-felling (an unfortunate term as economic considerations necessitate leaving the unsound and undersized trees and these supply adequate shade for the young growth as well as seed) is at least as good as the original stand. In fact Arthur F. Fisher, Director of Forestry, has stated (Pan American Union Forestry Series Publication No. 10) that the Phillippine forests are in a better

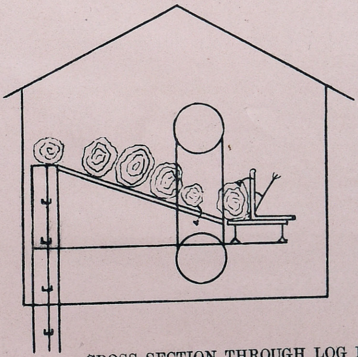
CADWALLADER-GIBSON
L B R. Co. SAWMILL
(LIMAY. P. I.)

DIAGRAM OF MILL FLOOR.





CROSS SECTION THROUGH TRIM SAW.
ROLLS, EQUALIZER, SKIDS & SKID SORTING TABLE.



CROSS SECTION THROUGH LOG HAUL.
LOG DECK BAND SAW & CARRIAGE

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NOTE.—Reproduced from the original received from the Chief Forest Engineer, Madras.

Vandyke., Survey Office, Madras.
1926.

condition after logging than before. The problem the Philippine Sylviculturist concerns himself with is the control of regeneration to get a new forest of the most valuable species instead of the mixed stand that comprises the natural forest.

THE FOREST SCHOOL OF THE UNIVERSITY OF THE PHILIPPINES.

A Forest School was established by the Bureau of Forestry of the Philippine Islands in 1910 for the training of Forest Rangers, and was carried on under the College of Agriculture until 1916, when a legislative enactment created a school in the University of the Philippines. In 1922 a three-year course leading to the degree of Bachelor of Science in Forestry was added to train selected graduates of the Ranger course with at least three years practical experience for the higher grades in the Bureau of Forestry.

The courses given to the Ranger class include English, Spanish, Mathematics, Botany, Dendrology, Sylviculture, Management, Administration, Woodsmanship and Military drill and Forest Engineering, the latter consisting Elementary Surveying and Mapping, Mensuration and Valuation, Forest Surveys and Elementary Logging Engineering.

The advanced degree course is divided into three years of two semi-sections each with two summer terms of practical field work between. In the first year courses in English and the basic sciences of Physics and Chemistry, Forest History and Policy, Forest Economics and Forest Entomology are given. The summer term is devoted to plane surveying and tropical dendrology. In the second year English, Chemistry and Mathemetics, and Forest Management, Protection, Administration, Sylviculture and Forest Engineering (constructions are given), Logging Engineering and Topographic Surveying on the operations of one of lumbering companies occupies the second summer term. The final year courses are in forest utilization—Logging, Sawmilling and Minor Products, Wood Technology, Forest Management and Research along some special line.

The Forest School is located in the Mount Makiling National Botanic Garden near Los Banos, Laguna. The faculty consists of five professors (American Forest School Graduates), eight graduate instructors and assistants and three special lecturers from the Bureau of Forestry. Instruction in language and science is given at the College of Agriculture by six members of that faculty.

Graduates of the Forest School are employed by lumbermen and plantation owners, by Governments in the East Indies and in China, but for the most part by the Bureau of Forestry itself.

The Professor in charge of the Forest School being also Chief of the Division of Investigation of the Bureau of Forestry, the Forest School takes an active part in research and investigative work of all kinds, to the mutual profit of the students and the Bureau.

SUGGESTIONS FOR MADRAS.

Every reader of this report will doubtless find in Philippine practice some ideas worthy of consideration in the forest development programme of Madras, but I venture to discuss briefly some points that appeal to me as being of particular importance.

It will have been noted that even with the huge investment in equipment and railroads the logging costs (Annas five delivered at the mill) are absurdly low compared with the cost of extracting timber in India. The explanation is quantity production—the same factor that makes for supremacy in any industry, be it manufacture of automobiles or boards and scantlings. We have already been taught this lesson in the one mechanical logging operation in Madras, where costs have steadily decreased with the progressive increase in outturn. To compete with the large amount of timber being imported into India and neighbouring countries we must produce *Volume*, thus absorbing overheads and reducing costs.

Here we find the necessity for substituting modern mechanical methods of logging and milling for the slower hand and animal power methods of the country which are incapable of expansion and speeding up, and producing volume. In the early days of forest exploitation in the Philippine Islands all logging was done by cariboo (water buffalo) and the cariboo is still extensively used for dragging out logs

by the small contractor. But animal haulage is limited in outturn and therefore costly, and had to give way before the power skidder and wirerope. In the same way the hand sawyer who could cut but a few pesos worth of lumber daily transferred his activities to a band or circular saw in the mill and produced much more at less cost and thus increased his own earnings.

To the critics who expect Government Forest exploitation enterprises to pay a big profit from their inception I would point out that the Philippine lumber industry, so profitable to both the private capital invested and to the Government, did not spring into being full-fledged but developed slowly, starting a quarter of a century ago when the United States of America took over the Philippines from Spain. The placing of hitherto commercially unknown woods on the market and the training of labour to produce them required years. The history of every lumbering company in the Philippines is a tale of discouragement, of staggering losses in their early years, and of unceasing struggle. But they eventually triumphed, and those men of vision who pioneered the development of tropical forest exploitation in the Philippine Islands are millionaires to-day.

In this report I have gone into the question of the relationship between the Government as represented by the Bureau of Forestry and the private Lumbering Companies operating in Government Forests in considerable detail because I believe that eventually we will come to much the same situation in Madras Presidency. Industrial enterprise is admittedly not a normal function of Government, yet under existing conditions Government must pave the way if the vast forest resources of this province are to be unlocked. Private interests appear unwilling to do the tremendous amount of experimental work necessary in placing unknown timbers from forests hitherto considered inaccessible on the market. But when the best methods of logging, milling and kiln-seasoning have been found, and a demand created for our woods in domestic and foreign timber markets, then local capital will be forthcoming to establish logging and milling operation on a large scale. When that time comes we cannot do better than profit by the experience of the Philippine Islands in formulating our policy governing the relations between the private companies and the Forest Department. I would particularly commend the system on which payment for public forest timber is based and the organization for Government supervision of private operations in Government lands as presented in this report.

Seigniorage or " stumpage " rates for Government timber extracted by private operators will be an important point to be settled in the future. I have included the schedule of rates paid in the Philippine Islands for timber in the forest as a basis for comparison. They will probably seem low to some forest officers who are inclined to value stumpage too highly. It must be recognized that timber standing in the forest, as such, is worth but little. Even in the Douglas fir region of North America, the biggest lumber producing region of the world, where large tracts of timber are increasingly difficult to buy and a continuous demand for their product exists, and stumpage values have been continually increasing, stumpage is to-day only worth an average of annas 2 per c.ft. Unless the true value of stumpage is recognized in the Forest Department I foresee danger of retarding the growth of this coming industry by excessive seigniorage rates.

The arguments of those opponents of mechanical logging in the tropics who characterize modern methods as too complicated for native labour, are effectually disposed of by Philippine experience. The Filipino is smaller in stature than the average Indian labourer yet he is handling satisfactorily heavier logging equipment than any yet introduced into India. Although of Malay stock, the Filipino logger and saw mill worker as he has increased in experience and skill has become imbued with some of the spirit of " hustle " that actuates his superiors and now literally jumps at his work, which, with the efficient machinery at his disposal, has made it possible for him to increase his earning power to quadruple that of his brother in India. With higher wages has come a higher standard of living, and conditions in the " barrios " or native villages in the vicinity of saw mills are noticeably superior to those elsewhere.

The activities of the Forest School of the University of Philippines in research and investigation work could with advantage be emulated by the Madras Forest College. The growth of the Forest Engineering Branch of the Madras Forest Department with its increasing demand for technically trained men in all grades, suggests

the advisability of adding to the curriculum of the Madras Forest College more extensive courses in logging, milling and utilization, in line with those given in the Philippine Forest School.

I have not gone into lumber markets and prices to any extent both because of my limited time in the Philippine Islands and because Mr. J. W. K. Wernham, Forest Utilization Officer of Madras, also visited the Philippines and his report will cover that subject.

CONCLUSION.

Enthusiasm for forest exploitation and utilization development in Madras, and optimism for its eventual success cannot but be strengthened by the inspiring example of what has been accomplished in the Philippine Islands under similar conditions. Their experience demonstrates conclusively that tropical forests can be worked by modern mechanical methods, and native labour; that a world market exists for tropical timbers; and that harvesting the forest crop is a profitable enterprise for all interests concerned.

Madras Presidency is favourably situated in having a domestic consumption so large that it is necessary at the present time to import timber, sawn lumber, and boxes to the value of *one crore of rupees annually* to supplement the inadequate local production; with huge timber markets of treeless Arabia and Africa at her very doors; and with a *four thousand mile shorter haul* to European markets than the Philippines. Of the 19,012 square miles of reserved forest in this province 2,000 square miles are conservatively estimated to be timber forests. At the present time only *two* square miles a year are being intensively logged. Obviously forest exploitation in Madras may be enormously expanded before any fear of exceeding the possibilities of the forest need be felt.

APPENDIX I.

"Grouping of Philippine Timbers."

First Group.

Akle (Albizzia acle).
Aranga (Homalium, all species).
Bakan (Litsea philippinensis).
Bansalagin (Mimusops parvifolia).
Batikuling (Litsea species; Lauraceae fulva; Machilus species; and all other species of Lauraceæ not listed by name and having soft yellow wood of similar type).
Batitinan (Lagerstroemia piriformis).
Betis (Madhuca betis).
Camagon (Diospyros discolor and all other species having characteristic reddish sapwood and black or streaky heartwood).
Duyokduyok (Mimusops calophylloides).
Ebony (Maba buxifolia).
Gisok (Shorea astylosa, Shorea balangeran, Shorea ciliata, Shorea falciferoides, Shorea malibato, Shorea scrobiculata and any other species of Shorea with wood of Yakal type).
Gisoka-takpang (Isoptera borneensis).
Ipil (Intsia, all species).
Kaburo (Phoebe sterculioides).
Kalantas (Toona, all species).
Malabunga (Nothophoebe malabonga).
Mancona (Xanthostemon verdugonianus).
Margapali (Dehasia triandra and other species).
Matang-usa (Litsea euphlebia).
Molave (Vitex celebica, Vitex parviflora, Vitex pubescens, and any other species with wood of same type).
Narra (Pterocarpus, all species).
Sasalit (Vitex aherniana).
Supa (Sindora supa).
Tambulian (Eusideroxylon zwageri).
Teak (Tectona grandis).
Tindala (Pahudia rhomboidea).
Urung (Fagraea fragrans).
Yakal (Hopea basilanica, Hopea foxworthyi, Hopea malibato, Hopea mindanensis, Hopea odorata, Hopea ovalifolia, Hopea philippinensis, Hopea plagata, and any other species of Hopea with wood of same type).

Second Group.

Akleng-parang (Albizzia procera and other species with wood of same type).
Alintatau (Neonauclea species).
Alupag (Euphoria, all species).
Alupag-amo (Litchi philippinensis).
Anubing (Artocarpus cumingiana, Artocarpus lanceolata, Artocarpus rubrovenia, Artocarpus subrotundifolia, Artocarpus superba, and any other species with wood of same type and small entire leaves, except Nangka, Artocarpus integra).
Banaba (Lagerstroemia speciosa).
Banuyo (Wallaceodendron celebicum).
Bitanhol or Palomaria del Monte (Calophyllum blancoi and other species not listed by name.
Bitaog or Palomaria de la Playa (Calophyllum inophyllum).
Bolong-eta (Diospyros pilosanthera and other species with characteristic reddish sapwood and little or no black heartwood).
Cana-fistula (Cassia javanica and other species with wood of same type).

Second Group—cont.

Dirigkalin (Xanthostemon bracteatus).
Dungon (Tarrietia sylvatica).
Dungon-late (Heritiera littoralis).
Guijo (Shorea guisa).
Hambabalud (Neonauclea reticulata).
Kalamansanai (Neonauclea calycina, and all other species not listed by name, except Neonauclea bernardoi).
Katmon (Dillenia philippinensis and all other species not listed by name).
Katmon-kalabau (Dillenia reifferschiedia).
Kayu-galu (Sindora inermis).
Kubi (Artocarpus lamellosa).
Lanete (Wrightia, all species of this genus or of other genera of Apocynaceae with wood of same type and large enough to furnish saw timber).
Lisak (Neonauclea bartlingii).
Makaasim (Eugenia, all species large enough to furnish saw timber).
Malabayabas (Tristania decorticata).
Malakadios (Beilschmiedia cairocan and other species).
Malakatmon (Dillenia luzoniensis).
Malugai (Pometia pinnata and other species).
Manggachapui (Hopea acuminata, Hopea glutinosa, Hopea maquillingensis, Hopea pierrei, and other species with wood of same type).
Manggis (Koompassia excelsa).
Mapilig (Xanthostemon sp.).
Manggis (Koompassia excelsa).
Maranggo (Azadirachta integrifoliola).
Narek (Balanocarpus cagayanensis, Balanscarpus brachyptera).
Narig (Vatica, all species).
Pamitaogen (Ctenolophon philppinensis)
Sudiang (Ctenolophon philippinensis).
Taba (Tristania littoralis).
Tabau (Lumnitzera, littorea).
Tamayuan (Strombosia philippinensis).
Tanglin (Adenanthera intermedia).
Tiga (Tristania sp.).
Tikim (Neonauclea vidalii).
Tioron (Neonauclea philippinensis).
Tukang-kalau (Aglaia clarkii).

Third Group.

Afu (Anisoptera brunnea).
Agaru (Dysoxylum decandrum and other species with wood of same type).
Agoho (Casuarina equisetifolia).
Agoho del monte (Casuarina, all species except above).
Alakaak (Palaquium gigantifolium).
Almaciga (Agathis alba).
Amamanit (Eucalyptus deglupta).
Amugis (Koordersiodendron pinnatum).
Anislag (Securinega flexuosa).
Antipolo (Artocarpus communis, Artocarpus ovatifolia, Artocarpus treculiana, and all other species with large incised leaves and wood of same type).
Apitong (Dipterocarpus grandiflorus and all other species not listed by name).
Batino (Alstonia macrophylla and other species, except Dita, Alstonia Scholaris).
Bayanti (Aglaia bicolor, and all other species not listed by name).
Binggas (Terminalia comintana).
Bulala (Nephelium mutabile).
Bulog (Aglaia everettii).
Dagang (Anisoptera curtisii).
Dalinsi (Terminalia pellucida).
Dao (Dracontomelum dao).
Dulitan (Palaquium merrillii).
Gisihan (Aglaia laevigata).
Hagakhak (Dipterocarpus pilosus).
Kalingag (Cinnamomum mercadoi).
Kalipaya (Palaquium ahernianum).
Kalumpit (Terminalia edulis).
Kamatog (Erythrophloeum densiflorum).
Kansalud (Aglaia multifoliola).
Kato (Amoora aherniana).
Kayatau (Dysoxylum terezaninowii).
Kuling-manuk (Aglaia luzoniensis).
Lamio (Dracontomelum lamiyo).
Lanipau (Terminalia crassiramea).
Lanutan (Bombycidendron, all species).
Lumbayau (Tarrietia javanica).
Lumbayau-batu (Tarrietia sp.).
Malabatino (Paralstonia clusiacea and other species with wood of same type).
Malakayan (Shorea plagata).
Malakmalak (Palaquium philippinensis).
Malasaging (Aglaia diffusa).
Malasantol (Sandoricum vidalii).
Malikmik (Palaquium canceatum).
Maniknik (Palaquium tenuipetiolatum).
Matamata (Aglaia elaeagnoides).
Mayppis (Shorea palosapis).
Miao (Dysoxylum euphlebium).
Nangka (Artocarpus integra).
Nato (Palaquium luzoniense and all other species not listed by name).
Oak (Quercus, all species large enough to furnish saw-timber).
Pagatpat (Sonneratia caseolaris).
Palakpalak (Palaquium lanceolatum).
Palosapis (Anisoptera thurifera and all other species not listed by name).
Panau (Dipterocarpus vernicifluus).
Pine (Pinus insularis, Pinus merkusii).
Red Lauan (Shorea negrosensis and any other species with wood of same type).
Sakat (Terminalia nitens).
Salamungi (Aglaia terezaninowii).
Salingkugi (Albizzia saponari).
Santol (Sandoricum koetiape).
Tabigi (Xylocarpus granatum).
Tagoaoi (Palaquium foxworthyi).
Talisai (Terminalia catappa).
Talisai-gubat (Terminalia oocarpa).
Tangile (Shorea polysperma and other species with wood of same type).
Tiaong (Shorea teysmanniana).
Toog (Petersianthus quadrialatus).
Unik (Albizza marginata).

There are at least six species of wood which are marketed under the trade name " Philippine mahogany ". These woods are closely related to each other botanically and are similar as regards mechanical properties, grain, and texture. They differ in color, however, and for this

reason they are classified into two classes, namely, the 'red' and the 'white' lauans. Under 'red lauans' are tangile, red lauan (proper), tiaong, and mayapis (although this is often sold under its own name). White lauans include white lauan (proper), almon, bagtikan, and manggasinoro.

Besides the lauans there are three other commercial woods, namely, yakal, guijo, and apitong, which belong to the same family as the lauans. These woods are harder and heavier than the lauans and are therefore suitable for such uses as require these properties. Lumbayau, of another family, is greatly favored abroad and is produced in larger quantities from Mindanao.

Characteristics of principle export woods.

Tangile (Shorea polysperma) } Pale red to dark.
Red Lauan (Shorea negrosensis) } Reddish brown (34 lb. cubic feet), medium hard and heavy; conspicuous ribbon grain when quarter sawn. Used for furniture interior finish, paneling, etc.

Tiaong (Shorea teysmaniana) Same as Tangile, except coarser in texture, softer and lighter. (33 lb. cubic feet).

Almon (Shorea eximia) Light red, moderately hard and heavy (34 lb. cubic feet) ribbon grain when quartered. Used for cabinet work, cases, etc.

Bagtikan (Parashorea malaanonan) Pale white to light red, slight brownish tinge. Hard and heavy (45 lb. cubic feet). Used for interior finish, furniture and cabinet work.

White Lauan (Pentacme contorta) Grayish brown similar to Bagtikan weight 36 lb. per cubic foot.

Manggasinora (Shorea philippinensis) Yellowish brown, moderately hard and heavy (36 lb. cubic feet). Furniture and interior finish.

Yakal (Hopea sp.) Yellowish brown. Very hard (59 lb. cubic foot). Used for high grade permanent construction sleepers, paving blocks, etc.

Apitong (Dipterocarpus sp.) Dark red, hard and heavy (45 lb. cubic foot). Used for general construction, flooring, etc. Durable when not exposed.

Guijo (Shorea guiso) Reddish color, hard and heavy (50 lb. cubic foot). High grade construction, flooring, cabinet work, ship and automobile building, cooperage.

Cabinet woods used locally.

Nara (Pterocarpus indicus) Pale reddish yellow to deep red, hard and heavy (45 lb. per cubic foot) Coarse texture. Most popular furniture wood in Phillippine Islands. Doors, windows, etc.

Ipil (Intsia sp.) Bright yellow, turns to brown with exposure. Very hard (56 lb. cubic foot) Strong, durable wood. High grade construction and interior finish.

Tindalo—Pale orange to deep red. Hard and heavy (56 lb.) Same uses as Ipil.

Reg.
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PLATE No. 1

PHOTOGRAPHED FROM THE ORIGINAL

TOPOGRAPHIC MAP OF

SAPPAL VALLEY

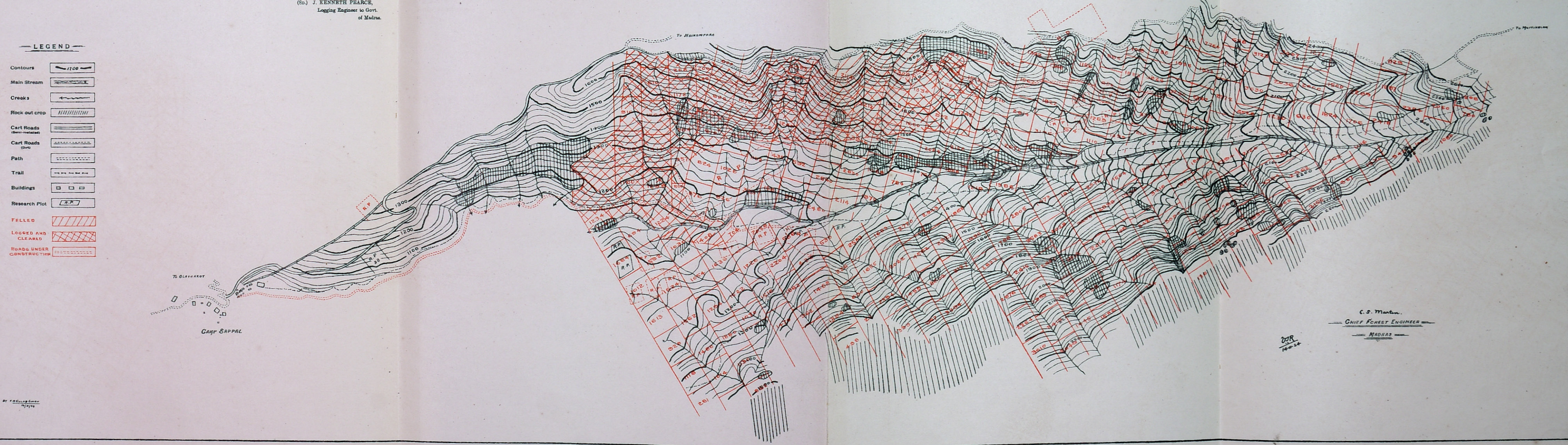
CHENAT NAIR RESERVE FOREST

Scale 1 Inch = 300 Feet

CONTOUR INTERVAL 20 FEET.

NOTE.—This map was prepared by Rangers and Foresters under the direction of the Logging Engineer using the Topographic Trailer Tape—Improved Abney Level method Mapping strips 4 chains wide run from Transit Traverse—Dumpy Levelled Base line in centre of valley up to Timber line. Elevations referred to B. M. on hydrant curb at Camp Sappal, assumed to be 1500 feet above sea level. Magnetic declination used 1°·58′ West. Mapped in April and May 1924, Roads corrected up to 31st October 1924.

(Sd.) J. KENNETH PEARCE,
Logging Engineer to Govt.
of Madras.



Reg. No. 264
Copies. 809+170

NOTE.—Reproduced from the original received from the Chief Forest Engineer, Madras.

Helio-Zinco., Survey Office, Madras
1925.

APPENDIX D.

FOREST ECONOMIST'S LISTS.

APPENDIX D

List of Woods tested and being tested by Firms and Organizations for special purposes.

Species.	Tested by	Purpose for which tested.	Report of result.
Adina cordifolia, Stephegyne parviflora, Snogeissus latifolia, and Lagerstrœmia lanceolata.	Messrs. Binny & Co., Madras.	Shuttle and picking sticks.	Reported that Anogeissus latifolia and Lagerstrœmia lanceolata are most suitable for picking sticks and further samples asked for.
Grewia tiliæfolia Artocarpus hirsuta, Artocarpus integrifolia.	Do.	Picking sticks ...	Not received.
Mesua ferrea	Do.	Do. ...	Most suitable. Enquiry for further supply has been received.
Calophyllum tomentosum.	Mr. John Roberts.	Billiard cues ...	Not suitable.
Polyalthia fragrans ...	Do.	Do. ...	Very suitable.
Pterospermum rubigionosum.	Pencil Factory, Madras.	Pencil wood ...	Not suitable and requested for another piece for testing fully.
Cedrela toona	Do.	Do. ...	Being arranged.
Acrocarpus fraxinifolius, Dichopsis elliptica, Holigarna arnottiana, Homalium zeylanicum, Calophyllum tomentosum.	Mr. Lancaster, Indian Leaf Tobacco Company, Chirala.	For hogs heads and barrels.	Suitable and indented for 100 barrels stave of Homalium zeylanicum.
Cullenia excelsa	Locomotive and Carriage Superintendent, Perambur.	For Railway Carriage building.	Not suitable.
Dichopsis elliptica ...	Do.	Do.	Being arranged for testing under correspondence.
Grewia tiliæfolia and Caolphyllum tomentosum.	Squadron Leader, Delhi.	For all skids and transport work for æroplanes.	Report awaited.
Artocarpus hirsuta (half-wroughts).	Superintendent, Rifle Factory, Kirkee.	For trial in Rifle components.	Being arranged for testing.
Adina cordifolia and Lagerstroemia lanceolata.	Director of Ordnance Factories, Simla.	For trial for Small Arm Ammunition boxes.	Do.
Demorocalamus strictus.	Lillywhites Limited, London.	For use in ski-sticks.	Being arranged for supply.
Grewia tiliæfolia, Anogeissus latifolia, Terminalia tomentosa, Hardwickia pinnata, Strychnos Nux vomica, Xylia dolabriformis, Dalbergia latifolia, Acacia arabica, Ougenia dalbergioides, Diospyros melanoxylon, Chloroxylon sweitenia, Tamarindus indica and Zizyphus trinervia.	Chief Inspector of Stores and Clothing, Cawnpore.	For trial for axe and tool handles.	Do.

List of Madras Timbers tested at Dehra Dun.

The following timbers have already been tested and results received:—

Project I.—(Test on small specimens, for mechanical and physical properties and safe working stresses).

- Teak.
- Cullenia excelsa.
- Dichopsis elliptica.
- Anogeissus latifolia.
- Hopea parviflora.
- Grewia tiliæfolia.

The following timbers have been arranged to be sent to Dehra Dun for testing under Project I:—

Acrocarpus fraxinifolius. Polyalthia fragrans. Terminalia tomentosa. Terminalia paniculata. Vateria indica. Alstonia scholaris. Grewia.	Out of these, Terminalia tomentosa, terminalia paniculata, vateria indica, and Grewia have also been arranged to be sent for holding stocks, for the manufacture of various articles of furniture, panelling, etc., for exhibition purposes.

The following timbers have been tested under Project II:—

- Cullenia excelsa.
- Dichopsis elliptica.
- Calophyllum tomentosum.

The following timbers have been arranged to be sent to Dehra Dun for testing under Project II, i.e., (Tests on large specimens for structural purposes):—

- Acrocarpus fraxinifolius.
- Polyalthia fragrants.
- Lagerstroemia lanceolata.

The following timbers have been sent for preliminary tests as sleepers for testing at Dehra Dun and tested under Project IV:—

- Cullenia excelsa.
- Dichopsis elliptica.
- Eugenia gardneri.
- Calophyllum tomentosum.

The following further lot of sleepers have been arranged for testing at Dehra Dun:—

- Cullenia excelsa.
- Eugenia gardneri.
- Vateria indica.
- Grewia tiliæfolia.
- Hardwickia binata.

Miscellaneous tests at Dehra Dun for which timbers have been arranged:—

Species.	Nature of tests.
Mahagony.	To compare with European markets
Gluta travancorica.	For making specimen planks
Cullenia excelsa. Dichopsis elliptica	Railway carriage building.
Calophyllum tomentosum.	Railway Roofing Boards to Great Indian Peninsula Railway.
Acrocarpus fraxinifolius.	For panelling and parquet flooring in the offices of new buildings.
Bluegum wood.	Preliminary testing for paper making.

General.—The leaves, fruits, flowers, and 2 cubic feet of the wood of almost all the Madras timbers were sent to Dehra Dun for identification in connection with the preparation of a book on 'The Anatomical Structure and Uses of Indian Timbers' by Dr. Brown, Wood-Technologist, Dehra Dun.

List of Madras timbers tested locally.

Preliminary testing of sleepers already done at Guindy and results received for:—

- Strombosia ceylanica.
- Stereospermum chelenoides.

N.B.—Arrangements are being made to do preliminary sleeper tests on two truck loads including about forty different species of timbers.

Project IV-Atn-Seasoning of Sleepers.

Terminalia tomentosa.
Terminalia paniculata.
Eugenia gardneri.
Cullenia excelsa
} Are to be tested at Pollachi.

List of Subject Ledger Files in Forest Economist's Office.

(1) Aircraft.
(2) Antiseptic treatment of wood—
Sub-file—Creosoting.
Powell process.
Other process.
(3) Artificial silk.
(4) Bibliography.
(5) Bobbins.
(6) Boxes—
Sub-file—General.
Tea chests.
Packing cases and crates.
Rubber chests.
(7) Canes.
(8) Charcoal.
(9) Cooperage.
(10) Depot-sizes and rates.
(11) Drying kilns.
(12) Fish float buoys.
(13) Forest policy and outlook.
(14) Glues.
(15) Grading.
(16) Handles.
(17) Imports.
(18) Interest per cent forestry.
(19) Joinery and cabinet making—
Sub-file—Doors, windows, balusters, etc.,
Furniture.
(20) Library.
(21) Log measurement tables.
(22) Machinery.
(23) Markets—
Sub-file—Indian.
Outside India.
(24) Matches.
(25) Microtome.
(26) Minor forest produce—
Sub-file—General.
Chulmugrah oil.
Contractors and enquirers.
Cutch.
Divi Divi.
Lac.
Mhowa flowers.
Nux vomica.
Sarasaparilla.
Tannin industry.
Wattle bark.
Leaf manure.
Myrabolams.
Rubber.
Oleo resin.
Flowers—Bassia latifolia.
Nandi and Umari.
Avaram bark.
Oils.
Fruits.

(26) Minor forest produce—*cont*

Sub-file—Fibre.
Floss.
Fungi.
Wax.
Palms.
Gums.
Resins.
Drugs.

(27) Paper pulp.
(28) Pencils and pencil woods.
(29) Periodicals.
(30) Photo frames.
(31) Ply wood—

Sub-file—General.
Veneers.

(32) Propaganda.
(33) Public Works Department Report on Madras Timbers.
(34) Rattans.
(35) Reports on Indian timbers.
(36) Research outside India.
(37) Saw mills.
(38) Seasoning.
(39) Separators.
(40) Shuttles and picking sticks.
(41) Skittle balls.
(42) Sleepers (railway).
(43) Sporting and pastimes—

Sub-file—General.
Golf shafts.
Billiard cues.
Fishing rods.
Cricket bats.

(44) Tenders.
(45) Tent pegs.
(46) Timber-testing—

Sub-file—General.
Project O.
Project I.
Project IV.
Spike pulling tests.

(47) Toys.
(48) Tropical woods.
(49) Wood preservation.
(50) Wood oil trees.
(51) Woods used in contact with the ground—

Sub-file—Railway sleepers.

(52) Wood technology.
(53) Wood waste.
(54) Wood wool.
(55) Logging.
(56) Musical instruments.
(57) Carriage and cartmaking.
(58) Automobile industry.